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SAINT THOMAS AQUINAS
EXPOSITION
OF
ARISTOTLE'S TREATISE ON THE HEAVENS

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[The text of Aristotle precedes each Lecture. The text of the Aristotle translation of *De Caelo* is drawn from *The Works of Aristotle,* ed. by W. D. Ross, trans. by J. L. Stocks (Oxford: Clarendon Press, 1922). Books I, II, and III with Aristotle preceding each appropropriate Lecture of Aquinas

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Aquinas' Exposition of Aristotle's Treatise on the Heavens

Introduction of St. Thomas

 p 1-1

Subject-matter of this book, and its relation to the subject-matter of natural science in general.

1. As the Philosopher says in *Physics* I, "We judge that we know a thing when we know the first causes and the first principles down to the elements." Plainly from this the Philosopher shows that in sciences there is an orderly process, a procedure from first causes and principles to the proximate causes, which are the elements constituting the essence of a thing. And this is reasonable: For the method pursued in sciences is a work of reason, whose prerogative it is to establish order; wherefore, in every work of reason is found some order according to which one goes from one thing to another. And this shows up not only in the practical reason, which considers things that we make, but in the speculative reason as well, which considers things made by some other source.

 p 1-1

2. The process from prior to subsequent is found in the act of the practical reason with respect to a fourfold

order: first, according to the order of *apprehension,* inasmuch as an artisan first apprehends the form of a house absolutely and then realizes it in matter; secondly, according to the order of *intention,* inasmuch as an artisan intends to complete the house and for that purpose does whatever he does to the parts of the house; thirdly, according to the order of *combining,* inasmuch as he first trims the stones and then joins them into one wall; fourthly, according to the order of *supporting the edifice,* inasmuch as the artisan first lays the foundation, upon which the other parts of the house are supported.

p 1-1

In like manner, a fourfold order is found in the consideration of speculative reason. First, because there is a process *from the general to the less general*. And this order corresponds to the first order which we have called "the order of apprehension," for universals are considered according to an absolute form, but particulars by applying form to matter, as the Philosopher in *On the Heavens* I says that the word "heaven" signifies a form, and "this heaven" signifies a form in matter. The second order is that according to which one goes *from the whole to the parts*. And this corresponds to "the order of intention," inasmuch as, namely, the whole is considered prior to the parts, not just any parts but parts which are according to matter and which are of the individual — as in the case of a semi-circle, in the definition of which "circle" is used (for it is "half a circle") and of an acute angle, in the definition of which "right angle" is used (for an acute angle is an angle "less than a right angle"). To be divided in that manner is incidental to a circle and to a right angle; hence, neither is a part of the species of a circle or right angle. For parts of this sort [i.e. parts of the species] are prior in consideration to the whole and are used in the definition of the whole, as are flesh and bones in the definition of man, as is said in *Metaphysics* VII.

p 1-2

The third order is that according to which one goes *from the simple to the combined,* inasmuch as composites are known in terms of the simple, as through their principles. And this order is compared to the third order, which is the "order of combining." But the fourth order is the one that calls for *the principal parts to be considered first,* as are the heart and liver before the arteries and blood. And this corresponds in the practical order to that order according to which the foundation is laid first.

p 1-2

3. This fourfold order is also considered in the procedure of natural science. For, first of all, things common to nature are determined in the book of the *Physics,* in which mobile being is treated insofar as it is mobile. Hence what remains in the other books of natural science is to apply these common things to their proper subjects. The subject of motion, however, is a magnitude and body, because nothing is moved except what is *quantified*.

p 1-2

Now it is in bodies that the three other orders are considered: in one way, insofar as the entire corporeal universe is prior in consideration to its parts; in another way, insofar as simple bodies are considered before the mixed; thirdly, insofar as, among the simple bodies, the first must be considered first, i.e., the heavenly body, through which all the others are sustained. And these three are treated in this book, which the Greeks entitle *On the Heavens*. For in this book are treated certain things that pertain to the entire universe, as is plain in Book I; and things that pertain to the heavenly body, as is plain in Book II; and things that pertain to the simple bodies, as is plain in Books III-IV. Consequently, it is with good reason that this book is first in order after the book of the *Physics*. For this reason the first topic of discussion in the very beginning of this book is *body,* to which must be applied all that was set forth about motion in the *Physics*.

p 1-2

4. Because diverse things are treated in this book, there was among the early expositors of Aristotle a

4. Because diverse things are treated in this book, there was among the early expositors of Aristotle a question about the subject of this book. For Alexander believed that the subject principally treated herein is the universe. Hence, since "the heavens" is subject to a threefold meaning — for sometimes it refers to the outermost sphere, sometimes to the whole body moved circularly, and sometimes to the entire universe — he asserts that this book is entitled *On the Heavens* as though meaning *On the Universe* or *On the World*. In asserting this he assumes that the Philosopher is herein determining certain matters pertaining to the entire universe, for example, that it is finite, that it is unique, and things of this sort.

p 1-2

On the other hand, it seems to some that the main subject handled in this book is the heavenly body which is moved circularly, for which reason it is entitled *On the Heavens*. Other bodies, however, are discussed therein consequentially, insofar as they are contained by the heavens and influenced by them, as Iamblichus said; or only incidentally, insofar as a knowledge of other bodies is assumed in order to explain what is being said of the heavens, as Syrianus says. But this does not seem probable, for after the Philosopher has finished his discussion of the heavens in Book II, he treats in Books III and IV of the other simple bodies as though they were his main subject. Now the Philosopher is not wont to assign a principal part in some science to things that are brought up only incidentally.

p 1-2

Therefore it seemed to others, as Simplicius said, that the intention of Aristotle in this book is to determine about simple bodies inasmuch as they share in the common notion of simple body; and because among simple bodies the chief is the heavens, on which the others depend, the entire book gets its name from the heavens. And, so he says, it makes no difference that in this book things pertaining to the whole universe are considered, for the conditions in question belong to the universe insofar as they belong to the heavenly body, i.e., to be finite and eternal, and so on. But if the principal intention of the Philosopher were to determine about the universe or the world, then he would have had to extend his consideration to all the parts of the world, even down to plants and animals, as Plato does in the *Timaeus*.

p 1-3

But the same argument could be used against Simplicius, because if Aristotle in this book intended to treat principally of the simple bodies, then in this book he would have had to mention everything that pertains to the simple bodies, whereas he discusses only what pertains to their lightness and heaviness, while he treats the other aspects in the book, *On Generation*.

p 1-3

5. Accordingly, the opinion of Alexander appears more reasonable, i.e., that the subject of this book is the universe itself, which is called "the heavens" or "the world," and that determination is made concerning simple bodies in this book accordingly as they are parts of the universe. Now, the corporeal universe is composed of its parts according to an order of position [situs]; consequently this book determines only concerning those parts of the universe that primarily and *per se* have position in the universe, namely, the simple bodies. That is why the four elements are not dealt with in this book from the aspect of their being hot or cold or something of that sort, but only with respect to their heaviness and lightness, from which their position in the universe is determined. Other parts of the universe, such as stones, plants and animals, have a determined place [situs] in the universe not according to what they are in themselves but according to the simple bodies; consequently, they are not treated in this book. And this agrees with what is usually said among the Latins, that this book discusses *body that is mobile with respect to position or place,* such motion being common to all the parts of the universe.

Lecture 1 (Aristotle's Text)

268a1-268a6

DE CAELO
BOOK I

[1] The science which has to do with nature clearly concerns itself for the most part with bodies and magnitudes and their properties and movements, but also with the principles of this sort of substance, as many as they may be. For of things constituted by nature some are bodies and magnitudes, some possess body and magnitude, †1 and some are principles of things which possess these. †2

Lecture 1 (Aquinas' Commentary)

p 1-4

BOOK I
Lecture 1

The things it pertains to natural science to consider.

p 1-4

6. In this first book Aristotle begins for the first time to apply to bodies the things that were said about motion in a general way in the book of the *Physics*. For that reason he

First shows by way of introduction that it pertains to natural science to determine about bodies and magnitudes;

Secondly, he begins to carry out his proposal (Lecture 2).

p 1-4

With respect to the first he presents this argument: Natural things are bodies and magnitudes and whatever pertains to these. But natural science is about natural things. Therefore, natural science consists in treating of bodies and magnitudes.

p 1-4

7. First [†1] therefore, he posits the conclusion, saying that the science which treats of nature seems to be "for the most part" concerned with bodies, and "magnitudes," i.e., lines and surfaces. However, the natural philosopher considers these in a different way from the geometer. For the former treats of bodies insofar as they are mobile, and of surfaces and lines insofar as they are the boundaries of mobile bodies; the geometer, on the other hand, considers them insofar as they are measurable quantities. And because a science should consider not only subjects but also their passions, as is said in *Post. Anal.* I, he therefore adds that natural science is concerned with the passions and motions of the aforesaid — by "passions" meaning alterations and other consequent motions, with respect to which something is altered in the substance of a thing; and he adds, "and motions," as though going from the particular to the general. Or perhaps by "motions" he specifically understands local motions, which are the more perfect in the genera of motions. Or by "passions" is meant the properties, and by "motions" the operations of natural things, which do not occur without motion. And because, in every science, principles must be considered, he adds that natural science is concerned with any and all the principles of the aforementioned substance, namely, mobile corporeal substance. By this we are given to understand that it pertains to natural science primarily to consider body insofar as it is in the genus of substance, for it is in this respect that it is the subject of motion; whereas it pertains to the geometer to consider it insofar as it is in the genus of quantity, for thus it is measured.

p 1-4

Since the minor premiss is plain, namely, that natural science is concerned with natural things, he adds the major, saying that the reason why natural science is concerned with the aforementioned is that among things which are according to nature, some are bodies and magnitudes, e.g. stones and other inanimate things; and some have body and magnitude, as do plants and animals, whose principal part is the soul (hence they are what they are more with respect to soul than with respect to body); finally, some things are principles of things having body and magnitude — for example, the soul, and universally form, and matter.

p 1-5

From this is clear why he said that the science of nature is "for the most part" concerned with bodies and magnitudes: for one part of this science is concerned with things having body and magnitude; it is also concerned with the principles of these; it is further concerned with some things which do not exist in nature but which some have attributed to bodies and magnitudes, namely, the void and the infinite.

Lecture 2 (Aristotle's Text)

[2] Now a continuum is that which is divisible into parts always capable of subdivision, [3] and a body is that which is every way divisible. [4] A magnitude if divisible one way is a line, if two ways a surface, and if three a body. [5] Beyond these there is no other magnitude, because the three dimensions are all that there are, and that which is divisible in three directions is divisible in all. [6] For, as the Pythagoreans say, the world and all that is in it is determined by the number three, since beginning and middle and end give the number of an 'all', and the number they give is the triad. [7] And so, having taken these three †3 from nature as (so to speak) laws of it, we make further use of the number three in the worship of the Gods. †4[8] Further, we use the terms in practice in this way. Of two things, or men, we say 'both', but not 'all': three is the first number to which the term 'all' has been appropriated. †5 And in this, as we have said, we do but follow the lead which nature gives. [9] Therefore, since 'every' and 'all' and 'complete' do not differ from one another in respect of form, but only, if at all, †6 in their matter and in that to which they are applied, body alone among magnitudes can be complete. For it alone is determined by the three dimensions, that is, is an 'all'. †1 But if it is divisible in three dimensions it is every way divisible, while the other magnitudes are divisible in one dimension or in two alone: for the divisibility and continuity of magnitudes depend upon the number of the dimensions, one sort being continuous in one direction, another in two, another in all. [10] All magnitudes, then, which are divisible are also continuous. Whether we can also say that whatever is continuous is divisible does not yet, on our present grounds, appear. One thing, however, is clear. We cannot pass beyond body to a further kind, as we passed from length to surface, and from surface to body. For if we could, it would cease to be true that body is complete magnitude. We could pass beyond it only in virtue of a defect in it; and that which is complete cannot be defective, since it has being in every respect. †2[11] Now bodies which are classed as parts of the whole †3 are each complete according to our formula, since each possesses every dimension. But each is determined relatively to that part which is next to it by contact, for which reason each of them is in a sense many bodies. [12] But the whole of which they are parts must necessarily be complete, and thus, in accordance with the meaning of the word, have being, not in some respects only, but in every respect. †4

Lecture 2 (Aquinas' Commentary)

p 1-6

Lecture 2

The perfection of the universe both as body and as containing all.

p 1-6

8. After showing by way of introduction that bodies and magnitudes are to be studied in natural science, the Philosopher here begins to carry out his main resolve. And because, as was said above, Aristotle in this

book is mainly concerned with determining about the corporeal universe and its principal parts which are the simple bodies, among which the most important is the heavenly body, the book therefore is divided into three parts:

In the first he determines concerning the corporeal universe;

In the second concerning the heavenly body, in Book II;

In the third about other simple bodies, i.e., heavy and light, in Book III.

p 1-6
With respect to the first he does two things:

First he shows the perfection of the universe;

Secondly, he determines certain of its conditions or properties (L. 9).

p 1-6
About the first he does two things:

First he shows the perfection of the universe;

Secondly, he explains of what parts it is composed (L. 3).

p 1-6
As to the first he does two things:

First he shows the perfection which the universe has in virtue of the common notion of its genus, i.e., inasmuch as it is a body, at 9.

Secondly, he proves the perfection proper to it, at 18.

p 1-6
About the first he does three things:

First he explains the definition of body, to be used in proving his proposition, at 9;

Secondly, he proves the proposition, at 15;

Thirdly, he shows what could be clear from the foregoing, at 16.

p 1-6
As to the first he does two things:

First he defines "continuum," which is the genus of body;

Secondly, he clarifies the definition of body, at 10.

p 1-6
9. With regard to the first [†2], we must consider that the continuum is found defined in two ways by the Philosopher. In one way with a formal definition, where it is said in the *Predicaments* (c. 4) that the continuum is "that whose parts are joined at one common term"; for the unity of a continuum is, as it were,

its form. In another way, with a material definition taken from the parts, which have the aspect of matter, as is said in *Physics* II — and it is thus that the continuum is defined here, namely, as "what is divisible into parts always divisible." For no part of a continuum can be indivisible, because no continuum is composed of indivisibles, as is proved in *Physics* VI. And it is fitting that this latter definition be used here, and the other one in the *Predicaments,* because the consideration of natural science is concerned with matter, while that of logic is concerned with notions and species.

p 1-6

10. Then at [†3] he defines "body." First he proposes the definition, saying that body is "a continuum which is divisible in every way," i.e., at every part or according to every dimension.

p 1-7

Secondly, at [†4] he proves the proposed definition with this argument: Body is divided according to three dimensions. But what is divided according to three dimensions is divided according to all. Therefore, body is divisible according to all the dimensions.

p 1-7

First, therefore, he explains the minor proposition as though by division. For among magnitudes there is one which is divided with respect to one dimension, and this is called "line"; another is divided with respect to two dimensions, and this is called "plane," i.e., a surface; still another is divided according to three dimensions, and since such a magnitude is neither line nor surface, it follows that it is body.

p 1-7

The major proposition he gives at [†5]. First he mentions it and says that, besides these magnitudes or dimensions, there is no other magnitude or dimension, on the ground that "three" has the property of being all, because it implies a certain totality, and because whatever is thrice seems to be "in all ways" and "entirely," i.e., according to every mode.

p 1-7

11. Secondly, at [†6] he proves what he had said in three ways.

p 1-7

First, according to the teaching of Pythagoras who said that what is called "whole" and "all" is determined by the number 3. For the beginning and the middle and the "consummation," i.e., the end, have a number which befits what is "whole" and "all" — for in things divisible, the first part is not enough to complete the whole, which is completed by the ultimate that is reached by passing from the beginning through the middle. But these three, namely, beginning, middle and end, have 3 as their number. Consequently, it is clear that the number 3 belongs to the "all" and "whole."

p 1-7

12. Secondly, at [†7] he proves the same by means of what is observed in divine worship. For we use this number 3 "in the worship of the gods" (whom, namely, the gentiles worshipped), i.e., in sacrifices and praises for them, as though we should receive from nature its laws and rules: just as nature completes all things with the number 3, so those who established the divine worship have, in their desire to attribute to God everything perfect, attributed to Him the number 3.

p 1-7

13. Thirdly, he proves at [†8] the same by appealing to the general way we speak. And he says that we even assign names to things according to the aforementioned method, in which perfection agrees with the

number 3. For when there are two things, we say "both," — thus we speak of two men as "both" — but we do not say "all," which we use for the first time in the case of three. And we all in general use this way of speaking, because nature so inclines us. For whatever is peculiar to individuals in their way of speaking seems to arise from the particular conceptions of each, but what is generally observed among all would seem to arise from natural inclination.

p 1-7

14. Now, it should be noted that nowhere else does Aristotle either use the arguments of Pythagoras to explain a proposition, or from the properties of numbers conclude anything about things. And perhaps he does so here on account of the affinity of numbers to magnitudes, which he is now considering.

p 1-7

Be that as it may, the proof here given does not seem valid, for it does not seem, if 3 is the number corresponding to "whole" and "all" that it follows there are three dimensions. Otherwise, it would follow according to the same reasoning that there would be only three elements or only three fingers on the hand.

p 1-8

But it should be known that, as Simplicius says in his *Commentary*, Aristotle is not here proceeding demonstratively but according to probability, and this is sufficient after previous demonstrations or ones supposed from another science. Now, it is plain that the task of deciding about the dimensions of bodies as such pertains to mathematics; and whatever the natural philosopher considers with respect to dimensions, he takes from mathematics. Therefore, to prove demonstratively that there are just three dimensions pertains to mathematics — thus Ptolemy proves it by showing that it is impossible for more than three perpendicular lines to meet at the same point, while each dimension is measured according to a perpendicular line. Supposing such a demonstration from mathematics, Aristotle here uses testimony and signs, just as he customarily does after his own demonstrations.

p 1-8

15. Then at [†9] he goes on to manifest the main proposition from what has been shown. And he says that these three, namely, "all," "whole," and "perfect," do not differ from one another according to species, i.e., according to their formal notion, because all imply a certain completeness; but if they do differ in any way, it is in matter and subject, insofar as they are said of diverse things. For we use "all" in discrete things, as we say "all men"; we use it also with respect to continua which are easily divided, as we say "all water" and "all air." "Whole," however, is used both with these and with all continua, as we say "the whole people" and "the whole world." But "perfect" is used with respect to these and forms: for we say "perfect whiteness" and "perfect virtue." Therefore, because "all" and "perfect" are the same, the consequence is that among magnitudes the perfect one is body, because only a body is determined by three dimensions, and this carries with it the notion of "all," as has been shown above, for since it is divisible in three ways, it follows that it is divisible in every way, i.e., according to every dimension. But among other magnitudes, there is one divisible according to two dimensions, namely, a surface; and another according to one, namely, a line. "Now according to the number that it has," i.e., the number of dimensions that a magnitude has, so is it divisible and continuous. Thus one magnitude is continuous in one way, namely, a line; another in two ways, namely, a surface; but a body is continuous in every way. Hence it is plain that body is a perfect magnitude, as possessing all ways of being continuous.

p 1-8

16. Then at [†10] he shows what is or is not plain from the foregoing. And he mentions three things. The first of these is plain in itself, namely, that any magnitude that is divisible is continuous; for if it were not continuous, it would not be a magnitude but a number. The second is the converse of this, namely, that every continuum is divisible, as was indicated in the definition. And this is plain from what was proved in

Physics VI, as was said above. But it is not plain from what was just said, however, because here he supposes, but does not prove, that a continuum is divisible. The third thing is plain from the foregoing, namely, that unlike the passing from length to surface and from surface to body, there is no passing from body to another kind of magnitude. And he uses a way of speaking employed by geometers imagining that a point in motion makes a line, and a line in motion a surface, and a surface a body. But from body there is no transition to another magnitude, because such a passing, i.e., to another kind of magnitude is due to a defect in that from which the process beings — that is why natural motion is the act of an imperfect thing. But it is not possible that body, which is perfect magnitude, should be defective in this way, because it is continuous in every way. Consequently, no transition from body to another kind of magnitude is possible.

p 1-9

17. Then at [†11] he manifests the proper perfection of the universe based on its difference from particular bodies. First he mentions how particular bodies are related to perfection. And he says that each particular body, according to the common notion of body, is such, i.e., perfect, inasmuch as it has three dimensions; nevertheless, it is terminated at an adjacent body, inasmuch as it touches it. And thus every such body is in a certain way "many," i.e., perfect, in having three dimensions, but imperfect in having another body outside it at which it is terminated. Or it is "many" according to contact with diverse bodies; or it is "many" because there are more than one in one species due to imperfection, whereas such is not the case with the universe.

p 1-9

18. Secondly at [†12] he shows how the universe is related to perfection. And he says that "the whole," i.e., the universe, which has particular bodies as its parts, must be perfect in all ways, for the word "universe" signifies perfect "in all ways," and not in one way to the exclusion of some other way, and it both has all the dimensions, and includes in itself all bodies.

Lecture 3 (Aristotle's Text)

268b11-268b26

[13] The question as to the nature of the whole, whether it is infinite in size or limited in its total mass, is a matter for subsequent inquiry. †1 We will now speak of those parts of the whole which are specifically distinct. †2 Let us take this as our starting-point. [14] All natural bodies and magnitudes we hold to be, as such, capable of locomotion; for nature, we say, is their principle of movement. †3[15] But all movement that is in place, all locomotion, as we term it, is either straight or circular or a combination of these two, [16] which are the only simple movements. And the reason of this is that these two, the straight and the circular line, are the only simple magnitudes. [17] Now revolution about the centre is circular motion, [18] while the upward and downward movements are in a straight line, 'upward' meaning motion away from the centre, and 'downward' motion towards it. [19] All simple motion, then, must be motion either away from or towards or about the centre. [20] This seems to be in exact accord with what we said above: †4 as body found its completion in three dimensions, so its movement completes itself in three forms.

268b27-269a2

[21] Bodies are either simple or compounded of such; and by simple bodies I mean those which possess a principle of movement in their own nature, such as fire and earth with their kinds, and whatever is akin to them. †5 Necessarily, then, movements also will be either simple or in some sort compound—simple in the case of the simple bodies, compound in that of the composite—and in the latter case the motion will be that of the simple body which prevails in the composition.

Lecture 3 (Aquinas' Commentary)

p 1-10
Lecture 3

Preliminary notions for showing the parts perfecting the universe.
p 1-10
19. After showing that the universe is perfect by reason both of its corporeity and its universalness, the Philosopher here shows from which parts its perfection is made up.

First he expresses his intention;

Secondly, he proves his proposition, at 20.

p 1-10
With respect to the first [†13] it should be considered that, as is said in *Physics* III, the ancients described

the infinite as "that outside of which there is nothing." Now, since he has proved that the universe is perfect on the ground that nothing is outside it, but that it embraces all things, one might think it to be infinite. Accordingly, meeting this opinion, he concludes by adding that later on, in discussing the nature of the whole universe, there will be treated the question of whether it is infinite in magnitude, or finite with respect to its total mass. But meanwhile, before treating of this, something must be said about those parts of it that are "according to the species," namely, those parts in which the integrity of its species consists, and which are the simple bodies. For animals and plants and other such are its secondary parts, and pertain more to the well-being of the universe than to its basic integrity. And we shall begin this consideration from a principle given below.

p 1-10

20. Then at [†14] he starts to manifest the proposition stating of which principal parts the perfect species of the universe is made.

p 1-10

First he shows that in addition to the four elements, another simple body must exist;

Secondly, that there is no simple body other than these five (L. 8).

p 1-10

About the first he does two things:

First he shows that there is a fifth body besides the four elements;

Secondly, how it differs from the four elements (L. 5).

p 1-10

With respect to the first he does two things:

First he mentions some preliminary facts needed in proving his proposition;

Secondly, he argues to the proposition (L. 4).

p 1-10

About the first he does two things:

First he premises facts regarding motion;

Secondly, facts pertaining to mobile bodies, at 32.

p 1-10

About the first he does two things:

First he mentions the connection between local motion and mobile bodies;

Secondly, he distinguishes the kinds of local motion, at 23.

p 1-10

21. He says therefore first [†14] that all physical, i.e., natural, bodies are said to be mobile with respect to place according to themselves, i.e., according to their very natures, and the same is true for other natural magnitudes, e.g., planes and lines, insofar as they are the boundaries of natural bodies. And this is true in

the sense that bodies are moved *per se,* but the other magnitudes *per accidens,* when the bodies are moved. In proof of this he adduces the definition of nature, which is "the principle of motion in those things in which it exists," as is said in *Physics* II. From this he argues thus: Natural bodies are ones that have a nature, but nature is a principle of motion in things in which it is; therefore, natural bodies have a principle of motion in them. But whatever is moved with any sort of motion is moved locally, but not conversely, as is plain in *Physics* VII, because local motion is the first of motions. Therefore all natural bodies are naturally moved with a local motion, but not all of them with all of the other motions.

p 1-11

22. This, however, seems to be false: for the heavens are a natural body, but their motion seems to be due, not to nature but to intellect, as is plain from what has been determined in *Physics* VIII and *Metaphysics* XII.

p 1-11

But it must be said that there are two kinds of principles of motion: one is active, i.e., the mover, as the soul is the active principle of the motion of animals; the other is a passive principle of motion, i.e., a principle according to which a body has an aptitude to be thus moved, and such a principle of motion exists in the heavy and the light. For these are not composed of a mover and a moved, because, as the Philosopher says in *Phys.* VIII, "it is plain that none of these — i.e., the heavy and the light — moves itself, but each has, with respect to its motion, a principle not of causing motion or of acting, but of being acted upon." Consequently, it must be said that the active principle of the motion of heavenly bodies is an intellectual substance, but the passive principle is that body's nature according to which it is apt to be moved with such a motion. And the same situation would prevail in us, if the soul did not move our body in any way other than according to its natural inclination, namely, down.

p 1-11

23. Then at [†15] he distinguishes local motions.

p 1-11

First he distinguishes in a general way both composite and simple local motions;

Secondly, he distinguishes simple motions, at 27.

p 1-11

With respect to the first he does two things:

First at [†15] he proposes what he intends, namely, that every local motion — which is called latio — is either circular, or straight, or composed of these, as is the oblique motion of things that are borne this way and that.

p 1-11

Secondly, at [†16] he proves what he had said, on the ground that there are just two simple motions, the straight and the circular. And the reason for this, he says, is that there exist just two simple magnitudes, namely, the straight and the circular: but local motion is specified according to places, just as every other motion is specified according to its termini.

p 1-11

24. But it seems that Aristotle's proof is not suitable, because, as is said in *Post. Anal.* I, one does not demonstrate who crosses into another genus. Consequently, it seems unfitting to use the division of

magnitudes, which pertain to mathematics, in order to reach a conclusion about motion, which pertains to natural science.

p 1-11

But it must be said that a science which is by addition to some other science uses the latter's principles in demonstrating, as geometry uses the principles of arithmetic — for magnitude adds position to number, and thus a point is said to be "a positioned unit." In like manner, natural body adds sensible matter to mathematical magnitude. Consequently, it is not unfitting for the natural philosopher in his demonstrations to use the principles of mathematics — for the latter is not of a completely different genus but is in a certain way contained under the former.

p 1-12

25. Likewise, it seems to be false that only two magnitudes are simple, namely, the straight and the circular. For a helix [spiral] seems to be one simple line, because every one of its parts is uniform, and yet a helical line [such as a screw thread] is neither straight nor circular.

p 1-12

But it must be said that a helix, if one considers its origin, is not a simple line, but a combination of straight and circular. For a helix is produced by two imaginary motions, one of which is the motion of a line moving round a cylinder, and the other of a point moving through the line: if two such motions take place in a regular manner at the same time, a helix will be formed by the motion of the point in the moving line.

p 1-12

26. Likewise, it seems that circular motion is not simple. For the parts of a sphere that is in circular motion are not in uniform motion but the parts near the poles or near the center are moved more slowly, because they traverse a smaller circle in a given time; consequently, the motion of a sphere seems to be composed of fast and slow motions.

p 1-12

But it must be said that a continuum does not have parts in act but only in potency. Now, what is not in act is not in actual motion. Hence the parts of a sphere, since they are a continuous body, are not actually being moved. Hence it does not follow that, in a spherical or circular motion, there is actual diversity, but this is only potentially. This does not conflict with the simplicity about which we are now speaking, for every magnitude possesses potential plurality.

p 1-12

27. Then at [†17] he distinguishes simple motions.

p 1-12

First he mentions one, namely, the circular; Secondly, he mentions two that are straight, at 29; Thirdly, he concludes that the number of simple motions is three, at 30.

p 1-12

He says therefore first [†17] that circulation, i.e., circular motion is around the middle. And this is to be understood as around the middle of the world: for a wheel which is in motion around its own middle is not in circular motion in the proper sense of the word, but its motion is composed of ups and downs.

p 1-12

28. But it seems according to this that not all heavenly bodies are in circular motion: for according to

Ptolemy, the motion of the planets is in eccentrics and epicycles, which are motions, not around the middle of the world, which is the earth's center, but around certain other centers.

p 1-12

But it must be said that Aristotle was not of this opinion, but thought that all motions of the heavenly bodies are about the center of the earth, as did all the astronomers of his time. But later, Hipparchus and Ptolemy hit upon eccentric and epicyclic motions to save what appears to the senses in heavenly bodies. Hence this is not a demonstration, but a certain assumption. Yet if it be true, all the heavenly bodies are still in motion about the center of the world with respect to the diurnal motion, which is the motion of the supreme sphere that revolves the entire heaven.

p 1-13

29. Then at [†18] he distinguishes straight motion into two: namely, one which is up, and one that is down, and describes each in relation to the middle of the world, as he had described circular motion, in order to keep the description uniform. And he says that an upward motion is one from the middle of the world, but a downward motion is one to the middle of the world. The first of these is the motion of light things, the second of heavy things.

p 1-13

30. Then at [†19] he concludes to the number of simple motions. First he expresses the conclusion he intended, and says that as to simple *latio,* i.e., simple local motion, one must be from the middle, and this is the upward motion of light bodies; another must be to the middle, and this is the downward motion of heavy bodies; still another must be about the middle, and such is the circular motion of heavenly bodies.

p 1-13

31. Secondly, at [†20] he shows that this conclusion agrees with what has been said above. And he says that what has just been said about the number of simple motions seems to be a consequence of what was said above about the perfection of body, for just as the perfection of body consists in three dimensions, so the simple motions of body are distinguished into three kinds. But he says that this is "according to reason," i.e., according to a certain probability: for three motions are not properly equated to three dimensions.

p 1-13

32. Then at [†21] he gives some reflections about mobile bodies. In regard to this it must be known that, as was stated in *Physics* III, motion is an act of a mobile. Now an act is proportionate to the thing to be perfected. Hence motions ought to be proportionate to mobile bodies. But some bodies are simple, some composite. A simple body is one that has a principle of some natural motion in it, as is plain in the case of fire, which is light simply, and in that of earth, which is heavy simply, and in their species — as a flame is said to be a species of fire, and bitumen a species of earth. He adds the phrase, "and those related to them," on account of the intermediate elements, of which air has a greater affinity to fire, and water to earth. As a consequence, a mixed body must be one that, according to its proper nature, does not have in itself the principle of some simple motion.

p 1-13

And from this he concludes that some motions must be simple and some mixed: whether the mixed motion is not one but has diverse parts, as one composed of elevation and depression, or of a push and a pull, or whether the mixed motion is one, as is plain in oblique motion and motion upon a helical line. Accordingly, the motions of simple bodies must be simple and those of mixed bodies mixed, as seen in the motion of rain, or any body of this kind in which neither heaviness nor lightness totally predominates. And if it sometimes happens that a mixed body is moved with a simple motion, that will be due to the element

predominant in it, as iron is moved downwards according to the motion of earth which is predominant in its composition.

Lecture 4 (Aristotle's Text)

 269a2-269b17

[22] Supposing, then, that there is such a thing as simple movement, and that circular movement is an instance of it, and that both movement of a simple body is simple and simple movement is of a simple body (for if it is movement of a compound it will be in virtue of a prevailing simple element), then there must necessarily be some simple body which revolves naturally and in virtue of its own nature †1 with a circular movement. By constraint, of course, it may be brought to move with the motion of something else different from itself, but it cannot so move naturally, since there is one sort of movement natural to each of the simple bodies. [23] Again, if the unnatural movement is the contrary of the natural and a thing can have no more than one contrary, it will follow that circular movement, being a simple motion, must be unnatural, if it is not natural, to the body moved. If then (1) the body, whose movement is circular, is fire or some other element, its natural motion must be the contrary of the circular motion. But a single thing has a single contrary; and upward and downward motion are the contraries of one another. †2 If, on the other hand, (2) the body moving with this circular motion which is unnatural to it is something different from the elements, there will be some other motion which is natural to it. But this cannot be. For if the natural motion is upward, it will be fire or air, and if downward, water or earth. [24] Further, this circular motion is necessarily primary. For the perfect is naturally prior to the imperfect, and the circle is a perfect thing. This cannot be said of any straight line:—not of an infinite line; for, if it were perfect, it would have a limit and an end: nor of any finite line; for in every case there is something beyond it, †3 since any finite line can be extended. And so, since the prior movement belongs to the body which is naturally prior, and circular movement is prior to straight, and movement in a straight line belongs to simple bodies—fire moving straight upward and earthy bodies straight downward towards the centre—since this is so, it follows that circular movement also must be the movement of some simple body. †1 For the movement of composite bodies is, as we said, determined by that simple body which preponderates in the composition. These premises clearly give the conclusion that there is in nature some bodily substance other than the formations we know, prior to them all and more divine than they. [25] But it may also be proved as follows. We may take it that all movement is either natural or unnatural, and that the movement which is unnatural to one body is natural to another—as, for instance, is the case with the upward and downward movements, which are natural and unnatural to fire and earth respectively. It necessarily follows that circular movement, being unnatural to these bodies, is the natural movement of some other. [26] Further, if, on the one hand, circular movement is *natural* to something, it must surely be some simple and primary body which is ordained to move with a natural circular motion, as fire is ordained to fly up and earth down. If, on the other hand, the movement of the rotating bodies about the centre is *unnatural,* it would be remarkable and indeed quite inconceivable that this movement alone should be continuous and eternal, being nevertheless contrary to nature. At any rate the evidence of all other cases goes to show that it is the unnatural which quickest passes away. And so, if, as some say, the body so moved is fire, this movement is just as unnatural to it as downward movement; for any one can see that fire moves in a straight line away from the centre. [27] On all these grounds, therefore, we may infer with confidence that there is something beyond the bodies that are about us on this earth, different and separate from them; and that the superior glory of its nature is proportionate to its distance from this world of ours. †2

Lecture 4 (Aquinas' Commentary)

Lecture 4

Five reasons why, besides the 4 elements, there must be another simple body.

33. After stating in advance certain things necessary for showing the proposition, the Philosopher here begins to reason toward the proposition, and this with five arguments. The first [†22] is this: Circular motion is a simple motion. But a simple motion belongs primarily and *per se* to a simple body — because even though a simple motion might occur in a composite body, this will be with respect to the simple body that is predominant in it; for example, in a stone, earth predominates, according to whose nature it is moved down. Therefore, there must be a simple body which is naturally moved according to a circular motion.

Now, someone could object to this argument and say that, although a simple motion belongs to a simple body, yet that simple body which is circularly moved would not necessarily be different from the simple body that is moved with a simple straight motion. Accordingly, he rejects this by adding that nothing prevents diverse bodies from being moved unnaturally with some one motion, as when one body might be moved violently with the motion of another; but that one body be moved according to nature with the natural motion of some other body is impossible. For one simple natural motion must belong to one simple body, and diverse to diverse. Hence, if circular motion is simple and distinct from straight motions, then it must belong to a natural simple body that is different from the simple bodies that are moved with a straight motion.

34. But this seems to be false, namely, that one simple motion belongs to just one simple body, for downward motion is natural to both water and earth, and upward motion to fire and air.

But it must be said that local motion is attributed to the elements, not according to hot and cold, moist and dry, with respect to which the four elements are distinguished — as is plain in *On Generation* II — for these four properties are principles of alterations. But local motion is attributed to the elements with respect to heaviness and lightness. Hence the two heavy bodies are compared to local motion as one body; and the same for the two light bodies. For moist and dry, according to which earth and water, or fire and air, differ, have an incidental relationship to local motion. Yet in the realm of heavy and light there is a difference, for fire is light simply and absolutely, and earth heavy; while air is light compared to two elements and likewise water is heavy. Hence the motions of water and earth, or fire and air, are not completely the same according to species, because the termini according to which their motions are specified are not the same: for air is apt to be moved to a place below fire, and water to a place above earth.

35. Likewise it seems not necessary, if of one simple body there is one simple motion, that on this account any simple motion should belong to some [different?] simple body, any more than it is necessary that there be as many composite bodies as there are composite motions, which are infinitely diverse.

But it must be said that just as simple local motion does not correspond to a simple body with respect to hot and cold, and moist and dry, so neither does composite motion correspond to mixed body according to the degrees of mixture of those qualities, but rather according to a composition of heavy and light, according to the diversity of which is diversified the obliquity of a mixed body from the simple motion of the heavy or light. Neither of these diversities tends to infinity with respect to species, but only with respect to number.

36. Likewise it seems that according to this there are many simple bodies. For just as motions upward and downward seem to be simple motions, so too motions to the right and to the left, and those ahead and to the rear.

It must be stated therefore that, since simple bodies are the essential and first parts of the universe, the simple motions which are natural to simple bodies must be considered in relation to the condition of the universe. Since this latter is spherical, as will be proved later, its motion must be considered in relation to the middle, which is immobile, because every motion is founded upon something immobile, as is stated in the book, *On the Cause of the Motion of Animals*. Consequently, there must be but three simple motions, according to their diverse relations to the middle [center]: i.e., one which is from the center, one which is to the center, and one which is around the center. To the right and left, ahead and to the rear, are considered in animals but not in the whole universe, except in the sense that they are placed in the heavens, as will be said in Book II. And according to this the circular motion of the heavens is with respect to right and left, ahead and to the rear.

37. In like manner it seems that straight motion and circular are not of the same kind. For a straight motion belongs to a body not yet having its completeness of species, as will be said in Book IV, and existing outside its proper place, while a circular motion belongs to a body that has completeness of species and is existing in its proper place. Hence simple bodily motions do not seem to belong to simple bodies according to a same notion, but some motions seem to belong to bodies inasmuch as they are coming into being, while circular motion insofar as they have complete existence.

But it must be said that, since a motion is proportionate to the mobile as being its act, it is fitting that a body which is separated from generation and corruption and cannot be expelled from its proper place by violence should have a circular motion, which is proper to a body existing in its own place; but to other bodies that can be generated and corrupted there belongs a motion outside their proper place and which is incomplete in species. But this is not in the sense that a body which is naturally moved with a straight motion lacks the first complement of its species, namely, form, for it is the form that such a motion is consequent upon; but in the sense that it does not have its final complement which consists in attaining the end, which is a place that agrees with it and conserves it.

38. The second argument he gives at [†23] and in it he presupposes two principles: one of which is that a motion which is outside nature, i.e., violent, is contrary to a natural motion, as earth is according to nature moved downward but upward against its nature. The second principle is that one thing is contrary to one thing, as is proved in *Metaphysics* X. A third also must be presupposed from sense experience, namely, that there exists a body which is moved circularly. Now, if that motion is natural to that body, we have the proposition, in keeping with the previously given reason, namely, that that body which is moved in a circle

naturally is distinct from the four simple elements. But if such a motion is not natural to it, it must be against its nature.

p 1-16

Let us therefore first assume that that body in circular motion is fire, as some claim, or any of the other four elements. Then the natural motion of fire, which is to be moved upward, will have to be contrary to the circular motion. But this cannot be, for to one thing, one thing is contrary, and the motion contrary to an upward motion is a downward one; consequently, circular motion cannot be contrary to it. And the same holds for the other three elements. Likewise, if it be assumed that the body which is being moved circularly against its nature is a body other than the four elements, it would have to have some other natural motion. But this is impossible, because if its natural motion is up, it will be fire or air; if its motion is down, it will be water or earth. But we supposed that it is not one of the four elements. Accordingly it must be that the body moved in circular motion is being moved naturally with this motion.

p 1-16

Now according to what he says here Aristotle seems to be contrary to Plato who assumed that the body which is circularly moved is fire. But with respect to the truth, the opinion of both philosophers is the same on this point. For Plato calls the body which is being circularly moved "fire" on account of light, which is posited as a form of fire, but not as being of the nature of elemental fire. Hence he posited five bodies in the universe, and to these he adapted five bodily figures which geometers teach, calling the fifth body "aether."

p 1-16

39. But further, what is said here, namely, that for fire to be moved circularly is outside nature seems to be contrary to what is said in *Meteorology* I, where Aristotle himself sets forth that *hypeccauma*, i.e., fire, and the upper portion of the air, are carried along circularly by the motion of the firmament, as is plain in the motion of a comet.

p 1-16

But it must be said that that circulation of fire or air is not natural to them, because it is not caused from an intrinsic principle. Neither is it through violence or against nature, because such a motion is in them from the influence of a higher body, whose motion fire and air follow according to a complete circulation because these bodies are closer to the heavens, but water according to an incomplete circulation, i.e., according to the ebb and flow of the sea. Earth, however, as being most remote from the heavens, suffers no such change except with respect to the sole alteration of its parts. Now whatever is present in lower bodies from the impression of the higher is not violent for them or against nature, for they are naturally apt to be moved by the higher body.

p 1-16

40. Likewise it seems to be false, as here stated, that to one thing one thing is contrary, for to one vice both a virtue and the opposite vice are contrary, as to illiberality both prodigality and liberality are opposed.

p 1-16

But it must be said that there is only one contrary to one thing according to the same aspect, although from different aspects nothing forbids one thing from having several contraries: thus, if the same subject is sweet and white, black and bitter will be contrary to it. Accordingly, the virtue of liberality is contrary to illiberality as what is well ordered to what is disordered, but prodigality is contrary to it as superabundance is to defect. Now, it cannot be said that both motions, namely, the one that is upward and the one that is downward, are contrary to circular motion according to the common aspect of straightness. For straight and circular are not contrary, for they pertain to figure, to which nothing is contrary.

41. He gives the third argument at [†24]. With regard to this he first shows that circular motion is the first of local motions. For circular motion is related to straight motion, such as up or down, as circle is compared to straight line. A circle, i.e., a circular line, is proved to be prior to a straight line because the perfect is naturally prior to the imperfect. But a circle, or circular line, is perfect, because whatever is taken in it is a beginning and middle and end. Hence it does not suffer the addition of anything from without. But no straight line is perfect, whether it be an infinite line, which is imperfect because it lacks an end, from which things are called perfect in Greek, or a finite line, because every finite line can be increased, i.e., receive more quantity and so there is something outside it. Consequently a circular line is naturally prior to the straight. Therefore circular motion, too, is naturally prior to straight motion.

But a prior motion naturally belongs to a prior body. Now straight motion naturally belongs to some one or other of the simple bodies, as fire is moved upward and earth downward and toward the middle. And if it happens that a straight motion is found in mixed bodies, that will be due to the nature of the simple body predominant in it. Since, therefore, a simple body is naturally prior to the mixed, the consequence is that circular motion is proper and natural to some simple body which is prior to the elementary bodies that exist here among us. Thus it is clear from these facts that besides the bodily substances that exist here among us, there must be some bodily substance which is nobler and prior to all the bodies that exist among us.

42. But the assertion that no straight line is perfect seems to be false. For if the perfect is what has a beginning, middle and end, as we held above, it seems that a straight finite line, which has beginning, middle and end, is perfect.

But it should be stated that in order for something to be partially perfect it must have the beginning, middle and end in itself; but to be completely perfect it is required that there be nothing outside it. And this mode of perfection belongs to the first and supreme body which contains all bodies; and with respect to this mode a straight line is said to be imperfect and a circular line perfect.

Yet it seems that even according to this mode some straight lines are perfect, because the diameter of a circle cannot suffer addition.

But it must be said that this happens to it insofar as it is in such and such a matter, and not insofar as it is a straight line, from which aspect there is nothing to prevent additions being made. But a circle, precisely as circle, cannot suffer such addition.

43. But it seems that, if this is so, one cannot conclude that circular motion is perfect, because it does receive addition, since it is continuous and eternal, according to Aristotle.

To this it should be said that one revolution is complete in species when it returns to the beginning from which it started. Hence no addition is being made to the same revolution, but whatever follows pertains to another revolution.

p 1-18

Yet if only a thing to which no addition can be made is to be called perfect, it follows that neither man nor any finite thing in bodies is perfect, since additions can be made to them.

p 1-18

And it should be answered that things of this kind are said to be perfect with respect to their species, inasmuch as they can suffer no addition of anything pertaining to the notion of their species; but to a straight line can be added something that pertains to its species, and to that extent it is said to be imperfect insofar as it is a line.

p 1-18

But still it seems that a circle is not perfect. For a perfect thing among magnitudes is something having three dimensions, which our circular line certainly lacks.

p 1-18

To this it should be responded that a circular line is not an absolutely perfect magnitude, because it does not have everything that pertains to the notion of a magnitude. Yet it is perfect in the realm of lines, because linearly something cannot be added to it.

p 1-18

44. It also seems false that the perfect is prior to the imperfect. For the simple is prior to the composite and yet the latter is to the former as perfect to imperfect. To this it must be said that perfect is to imperfect as act to potency, and simply speaking, act is prior to potency in things that are diverse, although in one and the same thing that is moved from potency to act, potency is prior to act in time, but act is prior to potency according to nature, for this is what nature intends first and principally. Now the Philosopher does not mean here that the perfect is prior to the imperfect in one and the same thing, but in diverse things, nor does he intend to say that it is prior in time but in nature, as he expressly states.

p 1-18

45. Moreover it seems that the Philosopher is arguing in an unsuitable manner. For he proceeds from the perfection of a circular line to prove the perfection of a circular motion, and from the latter perfection he goes on to prove the perfection of a circular body. And so his proof seems to be circular, because a circular line does not seem to be anything other than that of the very body that is being moved circularly. And it should be said that a circular motion is proved to be perfect on account of the perfection of the circular line absolutely; then from the perfection of circular motion in common one proves that this body which is moved circularly is perfect. Thus one does not go from the same to the same, but from common to proper.

p 1-18

46. The fourth argument is given at [†25], and it proceeds from two assumptions. The first is that every simple motion is either according to nature or outside nature. The second is that a motion which is outside nature for one body is according to nature for another, as is clear in the upward motion which, for fire, is according to nature, and for earth is outside nature; and in the downward motion which is natural to earth, but outside nature for fire. Now it is manifest that a circular motion is present in some body, which the senses observe is moved circularly. And if such a motion is natural to it, we will have the conclusion, namely, that, besides the four elements, there is an additional body which is moved circularly. But if the circular motion is outside the nature of the body that is moved circularly, it follows from the foregoing assumption that for some other body it is according to nature, which body, consequently, will be of a different nature from the four elements.

47. Aristotle here seems to be at odds with himself, for above he proved that circular motion is not outside the nature of the body in circular motion, but here he supposes the contrary.

Accordingly some say that above the Philosopher was taking "outside nature" in the sense of "against nature" — for then a motion against the nature of some body would also be contrary to its natural motion, as he proceeded above. But here he takes "outside nature" in the more general sense of "not according to nature." Thus it includes both what is against nature and what is above nature, and it is in this sense that he assumes here that a body can be moved circularly outside its nature, just as it was said above that fire in its sphere is moved circularly outside its nature under the influence of the motion of the heavens.

But this seems to be against the intention of Aristotle. For he seems to take "outside nature" in the same sense in both cases, because both here and above he uses the example of motion which is upward and downward, which is against nature for one body, and according to nature for another. Therefore it is better to say that Aristotle in the first argument proved that some body is being moved circularly according to nature. And because someone could say that that body which is seen to be moved circularly is being moved against nature by this movement, he argues against this in two ways: in one way, by showing that that motion is not against nature, as is clear in the second argument and also in the third; in another way, by showing that, even if it is being moved against nature, it still follows that there is some other body which is moved circularly according to nature. Consequently what he denied above when speaking according to the truth of his own opinion, he here denies by using, so to speak, the assumptions of his adversaries.

48. Likewise it does not seem to follow that, if some motion is outside nature for one body, it is natural to some other body. For fire or any other body can be moved in a number of ways — yet this does not prove that such motions are natural to certain bodies.

But it should be noted that the Philosopher is here speaking of simple motion, to which the nature of a simple body is inclined as to one definite thing, whereas motions diversely various seem to be rather brought about by art, which can be a principle of diverse things. It should also be considered that, although a motion which for one body is beside nature is according to nature for another, yet it is not necessary that every body for which some motion is natural should have a motion that is beside nature: for every body which can suffer an impression from without has something proper and connatural to it, yet not every body can receive an impression from without so as to be able to have a natural motion.

49. The fifth argument is at [†26], and it is this. The conclusion of the foregoing argument was that if a body observed to be in circular motion is being moved outside its nature, then such a motion must be according to nature for some other body. And if this is granted, namely, that circular motion is according to nature for some body, then it is clear that there will be some first and simple body which is being moved circularly, on account of the simplicity and priority of circular motion, as is plain from the foregoing arguments, just as fire is moved upward and earth downward. But if the procedure of the foregoing argument is not admitted, and it is stated rather that all things in circular motion with respect to a periphery, i.e., a circumference, are being moved outside their nature, in such a way that this motion is not natural to any body, then such a thing seems to be marvelous and, indeed, wholly unreasonable. For it was proved in *Physics* VIII that only circular motion can be continuous and eternal. Now it is unreasonable that what is

eternal should be outside nature, and that a non-eternal motion should be according to nature. For we see that things which are outside nature quickly pass and cease to be, as in the case of the heat of water and the projecting of a stone into the air, while things that are according to nature are seen to last a longer time. Thus it is wholly necessary that circular motion be natural to some body.

p 1-20

If therefore the body which is observed to be carried along circularly is of the nature of fire, as some say, that motion will be beside its nature, just as a downward motion is. For we see that the natural motion of fire is upward according to a straight line. Accordingly, just as a downward motion is natural for another body, namely, earth, so a circular motion will be natural to some other body.

p 1-20

50. Finally, in summary, he concludes that if someone should reason from all the foregoing in the aforesaid manner, he will believe, i.e., firmly assent, that there is a body over and above the bodies which exist among us (i.e., the four elements and composites of them), a body that is separated from them and of a nature that is more noble than they to the extent that it is farther separated from them in space. For in the universe the bodies that contain are to contained bodies as form to matter, and act to potency, as was said in *Physics* IV.

Lecture 5 (Aristotle's Text)

269b18-270a12

[28] In consequence of what has been said, in part by way of assumption and in part by way of proof, it is clear that not every body either possesses lightness or heaviness. [29] As a preliminary, we must explain in what sense we are using the words 'heavy' and 'light', sufficiently, at least, for our present purpose: †1 we can examine the terms more closely later, when we come to consider their essential nature. †2 Let us then apply the term 'heavy' to that which naturally moves towards the centre, and 'light' to that which moves naturally away from the centre. [30] The heaviest thing will be that which sinks to the bottom of all things that move downward, and the lightest that which rises to the surface of everything that moves upward. [31] Now, necessarily, †3 everything which moves either up or down possesses lightness or heaviness or both —but not both relatively to the same thing: for things are heavy and light relatively to one another; air, for instance, is light relatively to water, and water light relatively to earth. The body, then, which moves in a circle cannot possibly possess either heaviness or lightness. For neither naturally nor unnaturally can it move either towards or away from the centre. Movement in a straight line certainly does not belong to it *naturally,* since one sort of movement is, as we saw, appropriate to each simple body, and so we should be compelled to identify it with one of the bodies which move in this way. Suppose, then, that the movement is *unnatural*. In that case, if it is the downward movement which is unnatural, the upward movement will be natural; and if it is the upward which is unnatural, the downward will be natural. For we decided that of contrary movements, if the one is unnatural to anything, the other will be natural to it. [32] But since the natural movement of the whole and of its part—of earth, for instance, as a whole and of a small clod—have one and the same direction, it results, in the first place, that this body can possess no lightness or heaviness at all (for that would mean that it could move by its own nature either from or towards the centre, which, as we know, is impossible); and, secondly, that it cannot possibly move in the way of locomotion by being forced violently aside in an upward or downward direction. For neither naturally nor unnaturally can it move with any other motion but its own, either itself or any part of it, since the reasoning which applies to the whole applies also to the part.

Lecture 5 (Aquinas' Commentary)

p 1-21
Lecture 5

Difference of the body moved circularly as to light and heavy

p 1-21
51. After showing that there is a body distinct from those that are here, namely, from the four elements, and from things composed of them, the Philosopher here shows the difference of this body from those which exist here.

p 1-21

First by comparing them with respect to local motion;

Secondly, with respect to other motions (L. 6);

p 1-21

About the first he does three things:

First he proposes what he intends;

Secondly, he proves the proposition, at 52;

Thirdly, he dismisses an objection, at 56.

p 1-21

He says therefore first [†28] that, since some of the foregoing statements were supposed (namely, that one thing has one contrary, and that there are but two simple magnitudes, the straight line and the circle, and any other such suppositions) and others were demonstrated from certain premises (for example, that there are three simple motions, and that circular motion is natural to some body which is different in nature from the bodies that exist here), it can be plain from the foregoing that that entire body which is being moved circularly has neither heaviness nor lightness, which are principles of certain local motions.

p 1-21

52. Then at [†29] he manifests his proposition. And because the principle of demonstration is "that which something is," as is said in *Post. Anal.* II, he first supposes the definitions of heavy and light, at 52;

Secondly, from these he argues to his proposition, at 54.

p 1-21

He says therefore first [†29] that in order to prove the proposition we ought to suppose what it is that we call "heavy" and what "light." And he says "suppose" because he is not perfectly investigating their definitions here, but he uses them as suppositions to the extent that the present demonstration requires. But they will be considered more carefully in Book IV, where their "substance," or nature, will be explained. Accordingly, he defines heavy as "That which is apt to be moved to the middle," and the light as "that which is apt to be moved from the middle."

p 1-21

53. He uses this mode of defining in order to keep himself from the contrary position of Plato, who said that in the world according to itself there is no "up" and "down," on account of the rotundity of the world: for a rotund body is everywhere uniform. He said that there is "up" and "down" in the world only with respect to us, who call "up" that which is above our head, and "down" that which is below our feet, so that if we were contrarily situated, we would call "up" and "down" in a contrary manner. Consequently, Plato does not admit an "up" and "down" in the very nature of things but only with respect to us.

p 1-21

Aristotle, however, uses these names according to the common way of speaking, in keeping with his statement in *Topics* II, that names are to be used as they are used for the most part; hence he calls "up" and "down" in the world what are generally called "up" and "down" by men. Yet they are distinct not only with respect to us, but also according to nature. For just as we distinguish "right" and "left" in ourselves

according to the diverse relationship to animal motion which is with respect to place, so too "up" and "down" in the world are distinguished with relation to the motions of the simple bodies which are the principal parts of the world. On this account he says that "up" is the place where light things are carried, and "down" the place where heavy things are carried. And this is reasonable: for just as in us the nobler part is that which is above, so in the world, light bodies are more noble, as if more formal. But here in order to proceed without calumny to the proof of the proposition, he defines "heavy" and "light" by their relation to the middle.

p 1-22

54. Then at [†30] he defines "heaviest" and "lightest." And he says that the heaviest is "that which stands under all things that are carried downward," while the lightest is "that which is at the top of all things that are carried up." And this must be understood as concerning those things that are carried upward and downward — for the heaven is not the lightest, even though it is above all, because it is not carried upward. Now it should be recognized that here he is already using "up" and "down" as though "up" and "down" arise as being where a motion from the middle, or to the middle, is terminated.

p 1-22

55. Then at [†31] he proves his proposition from the foregoing, and says that every body carried up or down must have heaviness absolutely, as does the heaviest, namely, earth, which stands under all, or must have lightness absolutely, as does fire, which is above all, or must have both, not in respect to the same, but in respect to diverse things. For the intermediate elements, namely, air and water, are mutually heavy and light, as air is light with respect to water, because it is carried above it, and the same is true of water with respect to earth; meanwhile, air with respect to fire is heavy, because it exists under it, and similarly water with respect to air. But the body that is moved circularly can have neither heaviness nor lightness. For it cannot be moved to the middle or from the middle, either according to nature, or outside nature.

p 1-22

And, that it cannot be so moved according to nature, is clear from the fact that a straight motion, which is to the middle, or from the middle, is natural to the four elements. But it was said above that one motion is natural to one of the simple bodies. Therefore it would follow that the body which is moved circularly would be of the same nature as one of the bodies that is moved in a straight line, the contrary of which was proved above. Similarly it cannot be said that a straight motion outside nature belongs to the body that is moved circularly. For if one of a pair of contrary motions is present in a body outside its nature, the other will be for it according to nature, as is plain from what has been said above. Therefore, if downward motion is outside nature for the fifth body, upward motion will be for it according to nature, and conversely. But both are false, as is plain from the preceding argument. It follows therefore that the fifth body, which is carried circularly, is not carried from the middle or to the middle, either according to nature or outside its nature. But every body having lightness or heaviness is moved according to nature by one of these motions, and outside its nature by the other. Therefore, the fifth body has neither heaviness nor lightness.

p 1-23

56. Then at [†32] he excludes a certain objection. For some said that the parts of the elements are perishable, so that when existing outside their proper place they are naturally moved with a straight motion, while the elements themselves according to their totality are imperishable and cannot ever be outside their proper place — whence they are being moved circularly in their places. Consequently a body that is being moved circularly in its place according to its totality need not lack heaviness and lightness.

p 1-23

To exclude this the Philosopher proposes that part and whole are naturally carried to the same place, as, for

example, in the case of the whole earth and one clod. And this is clear from the state of rest: for each thing is naturally moved to the place in which it is naturally at rest, and it is in the same place that the whole earth and part of it naturally rest. Hence it is clear that the whole earth has a natural inclination to be moved to the center, should it be outside its own place.

 p 1-23

57. Therefore from the foregoing two things follow: The first of these is that the whole fifth body has no lightness or heaviness — for, as is clear from the aforesaid reason, it would be moved naturally to or from the middle. Secondly, it follows from the supposition now introduced that, if any part were detached from a heavenly body it would be moved neither up nor down, for, since the whole and part are of the same nature, it does not befit either the entire fifth body, or any part of it, to be moved either according to its nature or outside it with any motion other than the circular.

Lecture 6 (Aristotle's Text)

 270a13-270a22

[33] It is equally reasonable to assume that this body will be ungenerated and indestructible and exempt from increase and alteration, [34] since everything that comes to be comes into being from its contrary and in some substrate, and passes away likewise in a substrate by the action of the contrary into the contrary, as we explained in our opening discussions. †1 Now the motions of contraries are contrary. If then this body can have no contrary, because there can be no contrary motion to the circular, nature seems justly to have exempted from contraries the body which was to be ungenerated and indestructible. For it is in contraries that generation and decay subsist.

Lecture 6 (Aquinas' Commentary)

 p 1-24
Lecture 6

The fifth body not subject to other motions.
 p 1-24

58. After having shown the difference between the fifth body and the other bodies that exist here from the standpoint of lightness and heaviness, according to which bodies have an inclination to local motion, the Philosopher here shows how the fifth body differs from bodies that exist here from the standpoint of other

motions, and shows that the former is not subject to the other motions to which these bodies are subject.

p 1-24

First he shows this by an argument;

Secondly, by signs (L. 7);

p 1-24

With respect to the first he does two things:

First he proposes what he intends [†33] and says that just as it has been pointed out above that the fifth body lacks heaviness and lightness, in like manner it is reasonable to believe that it is unproduced and imperishable, and incapable of increase and alteration, i.e., that it is not subject to generation and ceasing-to-be, or to growth or alteration.

p 1-24

Secondly [†34], he proves the proposition:

First he shows that the heavenly body is incapable of beinggenerated or corrupted;

Secondly, that it cannot be increased (L. 7);

Thirdly, that it cannot be altered (also in L. 7).

p 1-24

59. With regard to the first he presents the following argument: Whatever can be generated comes to be from a contrary and a certain subject or matter — for something comes to be from a contrary as from something non-permanent, but from a subject as from something permanent, as is plain in *Physics* I. Likewise, every body that is perishable ceases to be while some subject [continues to] exist. Also every case of ceasing-to-be is from a contrary active principle, for every ceasing-to-be is terminated at a contrary, as was said in the first discussions, i.e., in *Physics* I. But nothing is contrary to the fifth body. Therefore, it can be neither generated nor destroyed. He proves the middle [minor] proposition through the fact that the motions of contraries are contrary, as the light is moved upward and the heavy downward; but the fifth body's natural motion, which is circular motion, has no contrary motion, as will be proved later. Therefore nothing is contrary to this body. Thus nature seems to have acted rightly, exempting this body from contrariety as destined to be, i.e., having to be, unproduced and imperishable.

p 1-24

60. But two thoughts come to mind regarding what Aristotle says here: one is about his assumption that the body of the heaven is incapable of being generated and destroyed; the other is about the reason for it.

p 1-24

Now it should be known, with regard to the first, that some supposed the body of the heaven to be generable and perishable according to its very nature, as did John the Grammarian, called Philoponus. And in support of his contention he uses first the authority of Plato who supposed that the heavens and the entire world were generated. Secondly, he presents this argument: Every power of a finite body is finite, as was proved in *Physics* VIII; but a finite power cannot extend itself unto infinite duration (that is why something cannot be moved for an infinite time through a finite power, as was proved in the same book); therefore, a heavenly body does not have the power to be infinite in time. Thirdly, he forms the following objection: In every natural body there is matter and privation, as is plain from *Physics* I; but wherever there

is matter with privation, there is potency to cease to be; therefore, the heavenly body is perishable. And if anyone says that the matter of heavenly bodies is not the same as that of inferior bodies, he objects to the contrary — for, according to this, matter would have to be composite, made out of what is common to both matters, and out of what produces diversity between matters.

p 1-25

61. But these statements lack necessity. For the fact that Plato posited the heavens as generated was not drawn from an understanding that they were subject to generation, which Aristotle intends here to deny, but because it was necessary for them to have their existence from a higher cause, as composed of parts multiple and extended — which meant that their existence was caused by some one first thing, from which all multiplicity must be caused.

p 1-25

62. The objection that the power of a heavenly body is finite Averroes solved by saying that in a heavenly body there is a power for local motion, but no power, either finite or infinite, respecting existence.

p 1-25

But in this he is clearly going against Aristotle who later on in the same book supposes in sempiternal things a power to exist forever. But Averroes was deceived by supposing that the power respecting existence pertains solely to the passive power, which is the potency of matter; but the truth is that it pertains more to the power of the form, because everything exists through its form. Hence a thing has as much and as long an existence as the power of its form. Thus there is a power to exist forever, not only in heavenly bodies, but also in separated substances.

p 1-25

Therefore it should be said that whatever requires infinite power must be infinite. But the infinite, according to the Philosopher in *Physics* I, pertains to quantity, so that what lacks quantity is neither finite nor infinite. Now motion does have a quantity that is measured by time and magnitude, as is plain in *Physics* VI, and therefore the power which is capable of eternal motion is capable of an infinite effect — and consequently such a power must be infinite. But a thing's existence considered in itself is not a quantity, for it has no parts, but is entire and all at once. Rather it is accidental to it that it is quantified in one sense according to duration, insofar as it is subject to motion, and consequently to time, just as is the existence of changeable things. That is why the power of any bodily thing whose existence is subject to change cannot go beyond a finite duration. In another way the existence of a thing can be called quantified *per accidens* on the part of the subject, which has a definite quantity. Therefore it must be said that the existence of the heavens is not subject either to variation or time; hence it is not quantified by a quantity of duration, and consequently is neither finite nor infinite in this respect. But it is quantified according to the quantity of an extended body, and in this respect it is finite. Consequently it must be said that the power of existing of a heavenly body is finite, but that does not mean that it is limited to existing in a finite time, because temporal finiteness or infinity are accidental to a thing's existence, which is not subject to the variation of time. Nevertheless a power of this kind could not cause existence in an infinite magnitude nor even in a magnitude greater than the magnitude of the heavenly body.

p 1-26

63. Similarly Averroes solves the third objection by destroying it. For he denies that a heavenly body has matter, but says that a heavenly body is a subject that is actual being, to which its soul is compared as form to matter. Now if in stating that a heavenly body does not have matter he should mean matter in relation to motion or change, then it is true — for thus does Aristotle also say in *Physics* VIII and *Metaphysics* XII, namely, that a heavenly body has matter not with respect to existence but to "where," for the simple reason that this matter is not subject to a change according to being but to one according to "where." But if he

means that a heavenly body has matter in no way at all or no subject at all, then plainly he is wrong. For it is clear that that body is a being in act; otherwise it would not act on the lower bodies. But whatever is a being in act is either act itself, or has act. Now it cannot be said that a heavenly body is act, for then it would be a subsistent form, and something understood in act but not apprehended by sense. Therefore in a heavenly body there must be something which is the subject of its actuality.

p 1-26

However this subject or matter does not need to have privation, for privation is nothing but the absence of a form which is apt to exist in the matter; but in this matter or subject there is no other form apt to be — rather its form fills out the entire potentiality of the matter, since it is a certain total and universal perfection. And this is clear from the fact that its active power is universal, and not particular like the power of the lower bodies, whose forms as being particular cannot exhaust the entire potentiality of the matter; hence, together with one form there remains in matter the privation of another form which is apt to be in it. Similarly, we see that the lower bodies are subject to diverse shapes, but the heavenly body not. Accordingly, in a heavenly body there is not privation of any form but only privation of some "where." Consequently, it is not changeable with respect to form through generation and ceasing to be, but only with respect to "where." From this it is plain that the matter of the heavenly body is distinct and of a different nature from the matter of lower bodies, not on account of some composition, as Philoponus supposed, but on account of their relationship to diverse forms, of which one is total and the other partial — for thus potencies are diversified, namely, according to the diversity of acts to which they are in potency.

p 1-26

64. Therefore it is manifest from the foregoing that the body of the heavens according to its nature is not subject to generation and ceasing-to-be, as being first in the genus of mobiles, and the closest to immobile things. That is why it has a minimum of motion. For it is moved only with local motion, which varies nothing intrinsic to a thing. And among local motions it has a circular motion, which also has a minimum of variation, because in spherical motion the whole does not vary its "where" as to subject, but only in conception, as was proved in *Physics* VI; but the parts change their "where" even as to subject.

p 1-26

However, we do not say according to the Catholic faith that the heavens always existed, although we say that they will endure forever. Nor is this against Aristotle's demonstration here, for we do not say that they began to be through generation, but through an efflux from the first principle, by whom is perfected the entire existence of all things, as even the philosophers posited. From whom, however, we differ in this, that they suppose God to have produced the heavens co-eternal to Himself, but we posit that the heavens were produced by God according to their whole substance at some definite beginning of time.

p 1-27

65. Against this, however, Simplicius, a commentator on Aristotle, at this passage, objects on three counts. First, since God produced the heavens, therefore, through His essence and not through something added, since His essence is eternal and unchanging, the heavens have always proceeded from Him. Again, if the goodness of God is the cause of things, the goodness of God would have been idle and disengaged before the world existed, if the latter began to exist from some definite beginning of time. Again, whatever begins to exist in some determined part of time after previously not existing, this happens to it from the ordination of some higher motion from which it happens that this being begins now and not before, as a man begins to be now and not previously, according to the order of the revolution of the heavenly body. But there is no higher revolution or motion beyond the heavenly body. Therefore it cannot be said that the body of the heavens began to be now, so as not to have been before.

p 1-27

66. But these lack necessity. For the first statement that God acts through His essence and not through something superadded is true, but His essence is not distinct from His understanding, as in us, nor from His willing. Hence He produces according to His understanding and His willing. Now in things produced by an agent acting in virtue of his understanding and will, that which is produced must be as it was understood by the producer, and not as the producer is in his being. Hence, just as what is produced by God acting through His essence does not have to be, in other respects, in the same way as the divine essence, but such as it is determined by His understanding, so too it is not necessary that what is produced by God be as long-lasting as God, but only to the degree determined by His understanding.

p 1-27

And this applies also to the dimensive quantity of the heavens. For the fact that the heavens have such-and-such a quantity, and no greater, is a result of a determination of the divine intellect determining such a quantity for them, and adapting to them a nature proportionate to such quantity, just as He frees them from contraries so that they may be ungenerated and incorruptible, as stated in the text. The phrase in the text that "nature acted rightly" implies the action of an intellect acting for an end, for it is no nature other than the divine that has freed them from contraries.

p 1-27

Similarly, the statement that the divine goodness would have been idle and disengaged before the production of the world does not have any weight. For a thing is called "idle" that does not attain the end for which it is. But the goodness of God is not for the sake of creatures. Hence creatures would be idle if they did not attain to the divine goodness, but the divine goodness would not be idle even if it never produced a creature.

p 1-27

Again, the third objection applies to a particular agent, which supposes time and works in time. In this way what comes to be must be proportioned by the agent both to some part of time, and to the whole of time, or even to the cause of the whole of time. But we are dealing now with a universal agent who produces the whole time together with the things in time. So there is no place here for the question of why now and not before, as though there were presupposed some other preceding part of time, or some more general cause producing all of time. But the pertinent question here is why the universal agent, namely, God, willed time and the things in time not always to exist. And this depends on a determination of His intellect, just as in a house the artisan determines the size of one part of the house in relation to another part or to the whole house, but the size of the entire house he himself determines according to his understanding and will.

p 1-28

67. Another point remains to be considered about Aristotle's demonstration against which John the Grammarian objects: if nothing but what has a contrary can be generated and cease to be, then since there is no contrary of a substance, as is plain in animals and plants (similarly, nothing is contrary to a figure or a relation), none of these will be generated and cease to be.

p 1-28

To this Simplicius responds that this is to be understood about a contrary in the general sense as including even contrariety of privation and species, for that is Aristotle's meaning when he speaks of contraries in *Physics* I. And that is the way in which contrariety is found in all the foregoing, as the unformed is contrary to the formed, and the unfigured to the figured; but privation has no place in heavenly bodies, as has been said.

p 1-28

But this response, although true, is not *ad rem*. For Aristotle says that contrariety of local motions

corresponds to contrariety of bodies; and it is certain that no local motion corresponds to a privation. Consequently, it must be said that, as he himself will say later, nothing is contrary to substance with respect to its being a composite, or according to matter or substantial form; but there is something contrary to it according to its proper disposition to such a form, as fire is said to be contrary to water by reason of the contrariety of hot and cold. And such contrariety is required in all things that are generated and cease to be. But it is upon such contrariety that contrariety of motions according to heavy and light follow: through the absence of which, a heavenly body is understood to be free of all the contraries that accompany the heavy and the light.

p 1-28

68. Likewise, since he says that contrariety of motions corresponds to contrariety of bodies, it seems that fire is contrary more to earth than to water, because fire agrees with the former in respect of one quality, namely, dryness.

p 1-28

And it must be said that in this book the Philosopher is discussing simple bodies with respect to their position; for it is under this aspect that they are parts making up the universe. And according to this, the contrariety of fire to earth is greater than its contrariety to water. Yet it is true that fire has a greater contrariety to water from the viewpoint of active and passive qualities, which consideration belongs to the book *On Generation*.

p 1-28

69. Again, it does not seem to follow of necessity that nothing is contrary to a heavenly body just because nothing is contrary to the circular motion with which it is moved, because fire also in its own sphere, and the upper region of air, are moved circularly, as is said in *Meteorology* I, and yet there is a contrary to fire and air.

p 1-28

But it should be said that fire and air are not moved circularly as though by their own motion; rather they are carried along by the motion of the heavens. The heavenly bodies, however, are moved circularly by their own motion; consequently, the case is not the same.

p 1-28

70. Again, it seems that contrariety of motions does not attest to contrariety of mobiles. For the same numerical substance, which is not contrary to itself, is subject to contraries, as is said in the *Predicaments;* thus it is moved by contrary motions which are terminated at contraries: for example, a substance is moved by whitening and blackening and similar motions. Moreover, air existing in the place of water is moved upward, but in the place of fire downwards. Therefore the same thing is moved by contrary motions, and, consequently, contrariety of motions does not follow upon contrariety of mobiles. Furthermore, we see that the same soul is moved by the motions of vice and virtue, which are contrary motions.

p 1-29

With regard to this it must be considered that the Philosopher uses this proposition, namely, that if motions are not contrary, the mobiles also are not contrary. But he does not state the converse, that if the mobiles are not contrary the motions are not contrary (because someone could say that the motions of all bodies having contrariety are contrary, but not that all contrary motions involve contrary things): against which the foregoing objection is directed. Yet in truth contrariety of natural motions follows upon what is proper to the active or formal principles (which the motion follows upon), and not upon the contrariety of the passive or material principles, because the same matter is subject to contraries. And therefore nothing prevents the same subject from being affected by alterations caused by extrinsic principles, even though such alterations

same subject from being affected by alterations caused by extrinsic principles, even though such alterations be contrary. But if an alteration arises from an intrinsic principle, as when health is restored by the nature, then the contrariety of such alterations follows upon the contrariety of the mobiles. And the same holds for local motions, which we are now discussing: for such motions follow upon intrinsic formal principles.

p 1-29

Now, regarding the objection about air, it must be said that the contradiction which is included in all opposites requires in its very notion that it be with respect to the same thing and according to the same aspect. But the natural motion of air is not up and down with respect to the same thing; rather it is upward with respect to water and earth, and downward with respect to fire. Consequently such motions are not contrary, for they are not tending to contrary places but to the same place, i.e., the place which is above water and below fire.

p 1-29

What is said about the motion of the soul according to virtue and vice is not *ad rem* — for such motions are not natural but voluntary.

Lecture 7 (Aristotle's Text)

[35] Again, that which is subject to increase increases upon contact with a kindred body, which is resolved into its matter. †2 But there is nothing out of which this body can have been generated. †3[36] And if it is exempt from increase and diminution, †4 the same reasoning leads us to suppose that it is also unalterable. For alteration is movement in respect of quality; and qualitative states and dispositions, such as health and disease, do not come into being without changes of properties. But all natural bodies which change their properties we see to be subject without exception to increase and diminution. This is the case, for instance, with the bodies of animals and their parts and with vegetable bodies, and similarly also with those of the elements. And so, if the body which moves with a circular motion cannot admit of increase or diminution, it is reasonable to suppose that it is also unalterable.

[37] The reasons why the primary body is eternal and not subject to increase or diminution, but unaging and unalterable and unmodified, will be clear from what has been said to any one who believes in our assumptions. Our theory seems to confirm experience and to be confirmed by it. For all men have some conception of the nature of the gods, and all who believe in the existence of gods at all, whether barbarian or Greek, agree in allotting the highest place to the deity, surely because they suppose that immortal is linked with immortal and regard any other supposition as inconceivable. If then there is, as there certainly is, anything divine, what we have just said about the primary bodily substance was well said. [38] The mere evidence of the senses is enough to convince us of this, at least with human certainty. For in the whole range of time past, so far as our inherited records reach, †1 no change appears to have taken place either in the whole scheme of the outermost heaven or in any of its proper parts. [39] The common name, too, which has been handed down from our distant ancestors even to our own day, seems to show that they conceived of it in the fashion which we have been expressing. The same ideas, one must believe, recur in men's minds not once or twice but again and again. And so, implying that the primary body is something else beyond earth, fire, air, and water, they gave the highest place a name of its own, *aither,* derived from the fact that it 'runs always' †2 for an eternity of time. Anaxagoras, however, scandalously misuses this name, taking *aither* as equivalent to fire. †3

Lecture 7 (Aquinas' Commentary)

p 1-30
Lecture 7

The heavenly body is not subject to growth and decrease, or to alteration.
p 1-30

71. After showing that the fifth body is not subject to generation and corruption, the Philosopher here shows that it is not subject to increase and diminution [†35] and uses this argument: Every augmentable body is, with respect to something, subject to generation and corruption. To explain this, he proposes that every augmentable body is increased by the addition of something connatural that comes to it. This, indeed, while being first unlike, has become like by being resolved into its proper matter which, doffing its previous form, has assumed the form of the body to be increased — as bread, after being resolved into matter, receives the form of flesh, and thus, through being added to pre-existing flesh, produces increase. Hence wherever there is growth there must be generation and corruption into something. But there is nothing from which a heavenly body can be generated, as has been shown. Therefore it cannot be augmentable or decreasable.

p 1-30

72. Then at [†36] he shows that it is not subject to alteration. Now it might seem to someone that an easy way to remove alteration from the heavenly body would be by removing contrariety, for just as generation occurs from contraries, so too, does alteration. But it should be observed that Aristotle removed contrariety from the fifth body by removing from it contrariety of motion. Alteration, however, seems to occur not only according to the contrariety to which contrary local motions correspond, namely, heavy and light and whatever results from them, but also according to other contraries which do not pertain to this, for example, according to black and white. Accordingly, he uses another way, based on increase.

p 1-30

And he says that it is for the same reason that we estimate a heavenly body not to be alterable and not to be augmentable or perishable. For alteration is a motion affecting quality, as has been said in *Physics* V. But alteration, as was shown in *Physics* VII, properly takes place according to the third species of quality, which is "passion and passible quality": for although "habit and disposition" pertain to [the first species of] the genus of quality, they are not produced without a change made according to the passions, just as health and languor result from a change of cold and hot, moist and dry. Now all natural bodies that are changed with respect to passion or passible quality seem as a consequence to have growth and decrease, as is clear from the bodies of animals and their parts and even of plants, in which growth properly exists. The same applies also to the elements, which rarefy and condense with respect to a change in hot and cold, from which results a change into larger or smaller quantity which is in a sense the same as being increased and decreased. Thus it is plain that if a body which is moved circularly is not subject to increase or decrease it is not subject to alteration.

p 1-30

Finally, in summary he concludes that it is plain from the foregoing — if anyone wants to assent to the previous demonstrations without wantonly contradicting — that the *first body,* which, namely, is moved with the first and perfect motion, i.e., circular motion, is sempiternal (as not being subject to generation and corruption), that it undergoes neither increase nor decrease, and that it is not subject to aging or alteration or passion.

p 1-31

73. Nevertheless objections can be leveled against this argument of Aristotle on two counts. First of all against the conclusion. For it seems to be false that a heavenly body is not altered, for it is plainly evident that the moon is illumined by the sun and obscured by the shadow of the earth.

p 1-31

But it must be said that alteration is of two kinds. One is passive and according to it things are so added that something else is cast off, as, when something is altered from hot to cold, it loses heat and receives coldness. It is that kind of alteration, which takes place according to passions, that the Philosopher is here

excluding from heavenly body. But there is another kind of alteration which is perfecting, which occurs insofar as something is perfected by something else without loss to the former — this is the kind of alteration that the Philosopher in *On the Soul* II posits even in a sense power. Such an alteration nothing prevents from being in heavenly bodies, some of which receive virtues from others according to conjunctions and various aspects, but without any of them losing their own virtue.

p 1-31

74. The second objection is directed against the procedure of his argument: for it does not seem to be true that whatever is altered receives increase and decrease. For these result from the addition of something that is converted into the substance of what is increased, as is said in the book *On Generation* and in *On the Soul* II, and as was said above. Now the motion of increase does not exist except in animals and plants, for things that rarefy and condense are not increased by the addition of anything, as was proved in *Physics* V. Consequently, it seems unsuitable for Aristotle here to attribute the motion of increase not only to animals and plants and their parts, but to the elements as well.

p 1-31

But it should be said that Aristotle is here speaking of increase in the sense of any motion by which something proceeds to greater quantity. For he has not yet perfectly explained the nature of the motion of increase and it is his custom, before he has shown the true view, to use common opinions. But the force of his proof is not impeded by his having excluded increase from a heavenly body by excluding addition of a body changed into what is increased: for just as anything increased by addition is not utterly free of generation and corruption, so, too, what is increased by rarefaction.

p 1-31

However it is to be noted that in this proof he makes mention of *physical* bodies advisedly, because in mathematical bodies increase can occur without alteration — for example, a square grows by adding to it a gnomon, but it is not altered, as is said in the *Predicaments;* conversely, a thing can be altered without being increased, as when a triangle is made equal to a square.

p 1-31

75. Then at [†37] he manifests the proposition through signs. And he says that both reason and things that appear to be probable seem to support one another on this point. And he gives three signs. The first of which is taken from the general opinion of men, who posit many gods or one God, whom the other separated substances serve. All who believe thus, whether Greeks or barbarians, assign the highest place, namely, the heavenly, to God, namely, all those who believe there are divine beings. But they assign the heavens to the divine substances as though adapting an immortal place to immortal and divine beings. In this way God's habitation in the heavens is understood as appropriate according to likeness, that is, that among all other bodies this body more closely approaches to a likeness to spiritual and divine substances. For it is impossible for the habitation of the heavens to be assigned to God for any other reason, as though He should need a bodily place by which He is comprehended. If therefore divine beings are to be posited, and since, indeed, they certainly must, the consequence is that the statements made about the first bodily substance, namely, the heavenly body, were well made, namely, that the heavenly body is ungenerated and unalterable.

p 1-32

Although men suppose that temples are the place of God, they do not suppose this from God's viewpoint but from that of the worshippers, who must worship Him in some place. That is why perishable temples are proportioned to perishable men, but the heavens to the divine imperishability.

p 1-32

76. The second sign he gives at [†38] and it is taken from long experience. And he says that what has been proved by reason and common opinion occurs, i.e., follows, sufficiently — i.e., not absolutely but to the extent of human faith, i.e., so far as men can testify to what they have seen for a short time and from afar. For according to the tradition which astronomers have passed on concerning their observations of the dispositions and motions of heavenly bodies, in the whole time past there does not seem to have been any change affecting either the entire heavens or any of its own parts. Now this would not be, if the heaven were generable or perishable — for things subject to generation and corruption arrive at their perfect state little by little and step by step, and then gradually depart from that state, and this could not have been concealed in the heavens for such a long time, if they were naturally subject to generation and corruption.

p 1-32

However, this is not necessary but probable. For the more lasting something is, the greater the time required for its change to be noted, just as change in a man is not noticed in two or three years, as it is in a dog or other animals having a shorter life-span. Consequently someone could say that, even though the heavens are naturally corruptible, nevertheless they are so lasting that the whole extent of human memory is not sufficient to observe their change.

p 1-32

77. The third sign is given at [†39] and is based on a name given by the ancients, which endures to the present, and which gives us to understand that they thought the heaven to be imperishable just as we do. And lest anyone object that some before their time thought the heavens were subject to generation and corruption, he adds that true opinions are revived according to diverse times not once or twice but infinitely, supposing that time is infinite. For the studies of truth are destroyed by various changes occurring in these lower things, but because the minds of men are naturally inclined to truth, then when obstacles are removed, studies are renewed and men at last arrive at the true opinions which previously flourished, but false opinions need not be revived.

p 1-32

Consequently the ancients, supposing that the first body, namely, the heaven, to be of a nature different from the four elements, named the highest place of the world the "aether," thus applying to it a name based on the fact that it always runs for an eternity of time — for *thein* in Greek is the same as "to run." But Anaxagoras misinterpreted this name, attributing it to fire, as though the heavenly body were fiery — for *aethein* in Greek is the same as "to burn," which is proper to fire. But that a heavenly body is not of fire is plain from what has been said above [in L. 4].

Lecture 8 (Aristotle's Text)

270b26-270b31

[40] It is also clear from what has been said why the number of what we call simple bodies cannot be greater than it is. The motion of a simple body must itself be simple, and we assert that there are only these two simple motions, the circular and the straight, the latter being subdivided into motion away from and motion towards the centre.

270b32-270a33

[41] That there is no other form of motion opposed as contrary to the circular may be proved in various ways. [42] In the first place, there is an obvious tendency to oppose the straight line to the circular. For concave and convex are not only regarded as opposed to one another, but they are also coupled together and treated as a unity in opposition to the straight. And so, if there is a contrary to circular motion, motion in a straight line must be recognized as having the best claim to that name. But the two forms of rectilinear motion are opposed to one another by reason of their places; for up and down is a difference and a contrary opposition in place. †1[43] Secondly, it may be thought that the same reasoning which holds good of the rectilinear path applies also to the circular, movement from A to B being opposed as contrary to movement from B to A. But what is meant is still rectilinear motion. For that is limited to a single path, while the circular paths which pass through the same two points are infinite in number. †2[44] Even if we are confined to the single semicircle and the opposition is between movement from C to D and from D to C along that semicircle, the case is no better. For the motion is the same as that along the diameter, since we invariably regard the distance between two points as the length of the straight line which joins them. †3[45] It is no more satisfactory to construct a circle and treat motion along one semicircle as contrary to motion along the other. For example, taking a complete circle, motion from E to F on the semicircle G may be opposed to motion from F to E on the semicircle H. †1[46] But even supposing these are contraries, it in no way follows that the reverse motions on the complete circumference are contraries. «46 bis» Nor again can motion along the circle from A to B be regarded as the contrary of motion from A to C: for the motion goes from the same point towards the same point, and contrary motion was distinguished as motion from a contrary to its contrary. †2[47] And even if the motion round a circle is the contrary of the reverse motion, one of the two would be ineffective: for both move to the same point, because †3 that which moves in a circle, at whatever point it begins, must necessarily pass through all the contrary places alike. (By contrarieties of place I mean up and down, back and front, and right and left; and the contrary oppositions of movements are determined by those of places.) One of the motions, then, would be ineffective, for if the two motions were of equal strength, †4 there would be no movement either way, and if one of the two were preponderant, the other would be inoperative. So that if both bodies were there, one of them, inasmuch as it would not be moving with its own movement, would be useless, in the sense in which a shoe is useless when it is not worn. But God and nature create nothing that has not its use. †5

Lecture 8 (Aquinas' Commentary)

p 1-33

Lecture 8

Only five simple bodies required. No motion contrary to circular.

p 1-33

78. After showing the necessity of some body besides the four elements, the Philosopher here shows that the integrity of the universe requires no other body besides these five.

p 1-33

First he shows his proposition;

Secondly, he proves something he had assumed, at 79.

p 1-33

He says therefore first [†40] that from what was said in proving that there exists a fifth body in addition to heavy and light bodies, it can be shown that it is impossible for a greater number of simple bodies to exist. For as was said above, for each simple body there must be some simple motion. But there is no simple motion other than the ones previously mentioned: one of which is circular and the other straight, the latter being divided into two kinds, one of which is from the middle and is called "upward motion" and the other toward the middle and is called "downward motion." Of the latter two, the one which is toward the middle belongs to a heavy body, namely, to earth and water, while the one from the middle belongs to a light body, namely, to fire and air. Finally, the circular motion is assigned to the first and supreme body. Hence what remains is that there is no other simple body besides the ones mentioned. Consequently, the wholeness of the universe consists of these five bodies.

p 1-33

79. Then at [†41] he proves something he had assumed, namely, that there is not a motion contrary to circular motion. This he had assumed in the discussion in which he proved that the body of the heavens is not subject to generation and corruption. But the reason why he did not prove it right away, but waited until now, is that it is also useful in proving that there is not a greater number of simple bodies. For if there were a motion contrary to circular motion, it could be held that just as there are two bodies moved with straight motion on account of the contrariety of this motion, so there are also two bodies moved with circular motion. But this will not occur if it is plain that there is no motion contrary to circular motion. Therefore, on this point,

p 1-33

First he proposes what he intends, and says that there are many reasons to induce one to believe that there is not a circular motion contrary to circular motion.

p 1-33

80. Secondly, he establishes the proposition. In regard to this it must be noted that if there exists contrariety in circular motion, it must be in one of three ways: one is that a straight motion be contrary to circular motion; the second is that there be some sort of contrariety in the parts themselves of circular motion; the third is that one circular motion have some other circular motion contrary to it.

p 1-33

First therefore he shows that a straight motion is not contrary to circular motion;

Secondly, he shows that there is no contrariety in the parts of circular motion, at 83;

Thirdly, that there is no contrariety between complete circular motions, i.e., of one to another, at 89.

p 1-34

81. He says therefore first [†42] that what seems most opposite to something circular is something straight. For a straight line has no break, while an angular line does have a break, not through the whole, but in the angles; meanwhile a circular figure seems to have breaks throughout, as if the whole were an angle. According to this the straight and the circular seem to be contraries, as though at the farthest extremes.

p 1-34

And because someone could say that it is not the straight that is opposed to the circular, but rather the convex or "gibbous" which is opposed to the concave, to reject this objection, he adds that concave and "gibbous," i.e., convex, are seen to be opposed not only to one another, but to the straight as well. They seem to be mutually opposed after the manner of the combined and the juxtaposed, i.e., in terms of relation: for "concave" is said in relation to things that are inside [a circle or sphere], but "gibbous" with respect to things outside. Consequently, from every aspect, the straight is contrary to the circular, whether taken as concave or as convex.

p 1-34

And because the contrariety of motions is seen to follow the contrariety of the things in which the motion is, the consequence seems to be that if there is a motion contrary to circular motion, it should be most of all straight motion which, namely, is over a straight line. But straight motions are contrary to one another because of contrary places — for upward motion is contrary to downward because "up" and "down" imply a difference and contrariety of place. Consequently, one straight motion will have as its contrary some other straight motion, and a circular one. This, however, is impossible, for to one thing there is one contrary. Therefore, it is impossible for any motion to be contrary to circular.

p 1-34

82. But someone could object to the statement that the straight is most contrary to the circular. For it is stated in the *Predicaments* that nothing is contrary to figure, whereas "straight" and "circular" are differences in figure.

p 1-34

But it can be said that the Philosopher is here speaking hypothetically and not categorically. For if anything were contrary to the circular, it would be the straight most of all, for the reason given above.

p 1-34

It can also be said that in every genus there is found a contrariety of differences, as is plain from *Metaphysics* X, although there is not a contrariety of species in every genus: for although "rational" and "irrational" are contrary differences, "man" and "ass" are not contrary species. Consequently, there is a contrariety between straight and circular not as between species, but as between differences of the same genus. Such contrariety, which can be discerned in motions on the basis of the difference between straight and circular, is not a corruptive contrariety, of the sort, namely, which the Philosopher here intends to exclude from the heavenly body, such as is the contrariety of hot to cold. But nothing forbids contrariety according to the differences of certain genera from being in a heavenly body, for example, that of equal and unequal, or something of that kind.

p 1-34

John the Grammarian, however, objects against the Philosopher's seeming to state that concave and

John the Grammarian, however, objects against the Philosopher's seeming to state that concave and gibbous are opposed according to a relation: because relative things seem to be co-existent, but concave and gibbous are not necessarily together, for a spherical body can be exteriorly convex without being interiorly concave.

p 1-35

But in this he has been deceived, for the Philosopher is here speaking concave and convex as found in a circular line, and not as found in a spherical body, in which latter one can indeed exist without the other, but not in a line.

p 1-35

83. Then at [†43] he shows that there is no contrariety in the parts of circular motion.

p 1-35

First he excludes contrariety from the parts of this motion;

Secondly, he shows that contrariety of parts would not be enough for contrariety of the whole, at 88.

p 1-35

Regarding the first he does three things:

First he shows that there is not contrariety in the parts of circular motion if the parts are taken according to diverse portions of the circle which are designated between two points;

Secondly, he shows that there is not contrariety in the parts of circular motion, if the parts are taken according to the same semicircle, at 85;

Thirdly, if the parts are taken according to two semicircles, at 87.

p 1-35

He says therefore first [†43] that someone could think that the aspect of contrariety in motion upon a circular line, and that in motion upon a straight line, are the same. For if one straight line between two points, A and B, be designated, it is evident that the local motion occurring on the straight line from A to B will be contrary to the local motion from B to A. But the notion is not the same if a circular line be described through the two points, A and B, because between two points there can be but one straight line, but an infinity of curved lines, which are diverse portions of circles. Therefore it would follow that, if the motion from A to B over a circular line were contrary to the one which is from B to A over a circular line, an infinitude of motions would be contrary to one.

p 1-35

But it should be observed that, in place of what he ought to have said, namely, that the straight line between two points is one, he said that straight lines are "finite" — because if we take two points in diverse places, there will be between them finite straight lines [i.e., in finite number], but between any two points there could be described an infinitude of curved lines.

p 1-35

84. Against this argument John the Grammarian objects, since it does not seem to follow that to one motion there is an infinitude of contrary motions, but that to an infinite number there is. For with respect to each portion of the circle described between two points there will be two motions contrary one to the other. Likewise, the same difficulty seems to follow from the contrariety of straight motions. For it is manifest that just as an infinitude of curved lines can be described between two points, so from the center of the

that just as an infinitude of curved lines can be described between two points, so from the center of the world to the circumference there can be described an infinitude of straight lines.

p 1-35

But in regard to the first it must be said that if the contrariety of motions that occur through curved lines is to be according to the contrariety of the termini as happens in straight motions, then, from this supposition it follows that every motion from B to A through any of the curved lines is contrary to a motion from A to B. Thus it will follow not only that there is an infinitude of motions contrary to one motion, but also that to each of the infinite motions starting from one end there will be contrary the infinitude of motions beginning from the contrary end.

p 1-36

In regard to the second it must be said that all the infinitude of straight lines from the center to the circumference are equal, and therefore designate the same distance between contrary termini — therefore in all of them is present the same aspect of contrariety, which implies maximum distance. But all the infinitude of curved lines described between the same points are unequal; hence the same aspect of contrariety is not present in them, for the distance taken with regard to the quantity of the curved line is not the same in every case.

p 1-36

85. Then at [†44] he shows that there is not contrariety in circular motion according to one and the same semicircle. For someone could say that the motion upon one curved line from A to B has as its contrary not a motion from B to A through just any curved line but through one and the same — for example, through one semicircle. Let GD be that semicircle, such that the motion through it from G to D is contrary to the one through it from D to G.

p 1-36

But Aristotle proceeds against this on the ground that the semicircular distance from G to D is computed in terms of the diametric distance, not in the sense that the semicircle is equal to the diameter, but because we measure every distance by a straight line. The reason for this is that every measure ought to be certain and determinate and the smallest. Now between two points the length of a straight line is certain and determinate, because it can be but one, and it is the smallest of all the lines between the two points. But an infinitude of curved lines can be drawn between two points, and all are greater than the straight line drawn between the two given points. Hence the distance between two points is measured by a straight line, and not by the curved line of a semicircle or any other portion of the circle, either of a larger or a smaller circle. Therefore, since it belongs to the very notion of contrariety that it have maximum distance, as is said in *Metaphysics* X, then, since the distance between two points is not measured according to a curved line but according to a straight, the consequence is that a contrariety of termini does not bring about a contrariety in motions upon a semicircle, but only in motions upon the diameter.

p 1-36

86. But John the Grammarian objects against this, because not only do geometers and astronomers reckon the quantity of a curved line by a straight line, but they also do the converse: for they prove the quantity of a chord by means of the arc and that of the arc by the chord.

p 1-36

But in this he departs from the intent of Aristotle. For Aristotle does not intend to maintain that a curved line is measured by a straight, but that the distance between any two given points is measured by a straight line, for the reason just given.

He [John] objects too that in the heavens there is a greatest distance between two opposite points: for example, between the beginning of Aries and the beginning of Libra; consequently, if contrariety is the greatest distance, then according to this distance, contrariety can be found in circular motion.

But to this it should be said that that greatest distance is reckoned according to the quantity of the diameter and not according to the quantity of the semicircle — otherwise the beginning of Aries would be farther from the beginning of Sagittarius, to which it has a trinary aspect, than from the beginning of Libra to which it has the aspect of right opposition.

87. Then at [†45] he shows that there is not contrariety in circular motion according to two semicircles. And he says that the reasoning is similar to describing a whole circle and positing that the motion in one semicircle is contrary to a motion in the other. For let a circle have a diameter EZ dividing it into two semicircles called I and T respectively. Now someone could say that a motion from E to Z through semicircle I is contrary to the motion from Z to E through semicircle T. But this is disproved by the same argument as the first case: namely, because the distance between E and Z is not measured by a semicircle but by the diameter. But there is still another reason: namely, the motion which begins at E and proceeds to Z through I, and then returns from Z to E through semicircle T, is one continuous motion; but two motions that are contrary cannot be continuous with one another, as is plain in *Physics* VIII.

88. Then at [†46] he shows that even if those parts of circular motions were contrary, that would be no reason for concluding that there would be contrariety in circular motions as a whole; for contrariety of parts is no proof for the contrariety of the whole. Consequently, it is plain that what the Philosopher has just showed about contrariety of the parts of circular motion has been done for added measure in order to exclude contrariety entirely from circular motion.

89. Then at [†46 bis] he shows that to one complete circular motion there is not another circular motion contrary: and this for two reasons. The first of these is based on considering circular motion in general. Therefore, take a circle upon which A, B and G are described at three points. Suppose two circular motions occur upon this circle, one beginning at A through B to G and back to A; conversely, let the other start at A through G to B and back to A. He says then that these two motions are not contrary. For each begins at the same term A and terminates at the same term, namely, A; consequently, they neither begin at terms that are contrary nor end at terms that are contrary. But a contrary local motion is one that goes from contrary to contrary. Therefore, the two circular motions in question are not contrary.

90. The objector against this is once more John the Grammarian. First on the ground that the notion of contrariety in diverse things is seen to be diverse. For to be moved from contrary to contrary determines contrariety in straight motions; hence it is not necessary, if such contrariety is not present in circular motions, that on this account no contrariety may exist therein. Likewise, just as it is of the very nature of contrary motion in straight motions to be from contrary to contrary, so it is of the very nature of motion to be from one thing to another. Now, by the very fact that circular motion is from the same to the same, not only is it not from contrary to contrary, but it is not from one thing to another. Therefore there is excluded from circular motions not only that they be contrary, but that they be motions at all.

To the first objection it should be replied that to be from contrary to contrary is not a special property of the contrariety found in local motions in a straight line, but it is a common property of contrariety in all motions, as is plain in *Physics* V. And the reason for this is that contrariety is a difference according to form, as is shown in *Metaphysics* X. Now a motion possesses form or species from its terminus. Therefore, there can be contrariety in no motion, unless there is contrariety of termini.

p 1-38

To the second it must be said that circular motion, because it is the first of motions, has a minimum of diversity and a maximum of uniformity. And this even appears proportionally in the mobile and in the motion. In the mobile, indeed, because it does not change its "where" with respect to the whole subject, but only in conception, whereas each part changes its "where" even as to subject, as was shown in *Physics* VI. And similarly a part of a circular motion is from one to another with a difference as to subject; but the whole circular motion is indeed from the same to the same according to subject, but from one thing to another that differs only in conception. For if we take one circular motion from A to A, the A which is the terminus *a quo* and the terminus *ad quem* is the same as to subject, but differs in conception, insofar as it is taken now as beginning and now as end. And therefore, because circular motion has the most unity, its nature is very far from contrariety, which is a maximum distance. That is why such motion belongs to the first bodies which are the nearest to the simple substances which completely lack contrariety.

p 1-38

91. The second argument is at [†47], and this argument is based on applying circular motion to natural bodies. And this is the argument: If one circular motion were contrary to another, then one of them would have to be in vain. But nothing in nature is in vain. Therefore, there are not two contrary circular motions.

p 1-38

The truth of the conditional proposition he proves in the following manner: If there were two contrary circular motions, then the bodies subject to them ought to pass through the same signs marked on a circle. The reason for this is that contrariety of local motion demands contrariety of the places, which affect both mobiles. Consequently, if there were contrary circular motions, then contrary places should be able to be designated on the circle. Now on a straight line only two contrary places are designated, namely, those the greatest distance apart, while other places designated on that line, since they are within the extreme places, are not contrary to one another. But on a circle any point at random can be at a greatest distance from some other point on the circle: because from any point on the circle a diameter can be drawn, which is the greatest of the straight lines falling in the circle. And it has been said that every distance is measured according to a straight line. Therefore, because things in contrary motions must reach contrary places, then if circular motions are contrary, it is necessary that each body in circular motion, no matter from which point of the circle its motion begins, reach all the places of the circle, all of which are contrary. (Nor is it unfitting that in a circle places be marked as in every way contrary — for contrariety of place is taken not only with respect to up and down, but according to ahead and to the rear, and left and right.) But it has been said that the contraries of local motion are based on contrariety of places. And thus, if circular motions are contrary, the contrarieties in the circle must be taken according to the forementioned.

p 1-38

Now from all this it follows that one of the motions or of the bodies would be in vain. For if the magnitudes moved were equal, i.e., of equal power, neither would be moved, because one would totally obstruct the other, since both would have to traverse the same places. But if one motion dominated on account of a greater power in one of the mobiles or movers, then the other motion could not exist, because it would be totally obstructed by the stronger motion. Therefore, if both were bodies apt to be moved with contrary circular motions, one of them would exist in vain, for it could not be moved with that motion which was obstructed by the stronger. For we say that a thing is "in vain" when it does not realize its

usefulness, as we say that a shoe is in vain if no one can wear it. In like manner, a body would be in vain, if it could not be moved with its proper motion; and likewise a motion would be in vain if nothing could be moved with it.

p 1-39

Consequently, it is plain that if there are two contrary circular motions, there would have to be something in vain in nature. But that this is impossible he now proves: Whatever exists in nature is either from God, as are the first natural things, or from nature as from a second cause, as, for example, lower effects. But God makes nothing in vain, because, since He is a being that acts through understanding, He acts for a purpose. Likewise nature makes nothing in vain, because it acts as moved by God as by a first mover, just as an arrow is not moved in vain, inasmuch as it is shot by the bowman at some definite thing. What remains, therefore, is that nothing in nature is in vain.

p 1-39

It should be noted that Aristotle here posits God to be the maker of the celestial bodies, and not just a cause after the manner of an end, as some have said.

p 1-39

92. John the Grammarian objects against this argument that, for the same reason, someone could conclude that there is no contrariety in straight motions, because contrary mobiles obstruct one another.

p 1-39

But it should be said that the case with straight motions is different from that of circular, for two reasons. First, because two bodies are moved with contrary straight motions without mutually obstructing one another, for in straight motions contrariety is not reckoned except with respect to the extremes of straight lines, for example, with respect to the center of the world and its circumference. Now from the center to the circumference an infinitude of lines can be drawn so that what is moved upward through one of them does not obstruct what is being moved downward through another. But in circular motion the same aspect of contrariety is present in all parts of the circle. Therefore it will be necessary that both move through the same places of the circle. And so of necessity contrary circular motions would have to obstruct one another.

p 1-39

Secondly, in the two cases the aspect is different — for in the case of a body that is being naturally moved with a straight motion, just as it is naturally apt to be corrupted, so it is naturally apt to be obstructed. Hence, if it is obstructed, this is no more in vain than if it be corrupted. But a body circularly moved is naturally incorruptible: hence it is not apt to be obstructed. Hence if there were in nature something to impede it, that impediment would be useless.

p 1-39

93. Likewise, it can be objected about the motion of the planets which are moved with their own motions from west to east, which seems to be contrary to the motion of the firmament which in its diurnal motion is from east to west.

p 1-39

But it must be said that such motions have indeed a certain mutual diversity which somehow designates the diverse natures of the mobiles. But, for three reasons, there is no contrariety:

First, this is so, because diversity of this kind is not based on contrary termini but on contrary ways of reaching the same terminus; for example, because the firmament is moved from the eastern point to the

reaching the same terminus: for example, because the firmament is moved from the eastern point to the western point through the upper hemisphere, and returns to the eastern point through the lower hemisphere, while a planet is moved from a western point to the east through another hemisphere.

p 1-40

But to be moved to the same end by diverse routes does not make for contrariety of actions or passions, but pertains to the diverse order of the motions and mobiles — for what reaches its terminus by a nobler route is nobler, just as a better doctor is one who induces health by a more efficacious way. Hence the first motion of the firmament is nobler than the second motion, i.e., that of the planets, just as the supreme orb is nobler. Wherefore, the orbs of the planets are moved with the motion of the first orb without their being impeded from their own proper motions.

p 1-40

The second reason is that, although each motion is over the same center, nevertheless they are over other and other poles; hence they are not contrary.

p 1-40

The third reason is that they are not in the same circle, but the motions of the planets are in the lower circles.

p 1-40

But contrariety must be reckoned with respect to the same distance, as is plain in straight motions, the contrariety of which consists in the distance from the center to the circumference.

Lecture 9 (Aristotle's Text)

271b1-271b17

[48] This being clear, we must go on to consider the questions which remain. First, is there an infinite body, as the majority of the ancient philosophers thought, or is this an impossibility? [49] The decision of this question, either way, is not unimportant, but rather all-important, to our search for the truth. †1 It is this problem which has practically always been the source of the differences of those who have written about nature as a whole. So it has been and so it must be; [50] since the least initial deviation from the truth is multiplied later a thousandfold. †2 Admit, for instance, the existence of a minimum magnitude, and you will find that the minimum which you have introduced, small as it is, causes the greatest truths of mathematics to totter. The reason is that a principle is great rather in power than in extent; hence that which was small at the start turns out a giant at the end. Now the conception of the infinite possesses this power of principles, and indeed in the sphere of quantity possesses it in a higher degree than any other conception; so that it is in no way absurd or unreasonable that the assumption that an infinite body exists should be of peculiar moment to our inquiry. The infinite, then, we must now discuss, opening the whole matter from the beginning.

271b18-271b25

[51] Every body is necessarily to be classed either as simple or as composite; †3 the infinite body, therefore, will be either simple or composite. But it is clear, further, that if the simple bodies are finite, the composite must also be finite, since that which is composed of bodies finite both in number and in magnitude is itself finite in respect of number and magnitude: its quantity is in fact the same as that of the bodies which compose it. What remains for us to consider, then, is whether any of the simple bodies can be infinite in magnitude, or whether this is impossible. Let us try the primary body first, and then go on to consider the others.

271b26-272a7

[52] The body which moves in a circle must necessarily be finite in every respect, for the following reasons. [53] (1) If the body so moving is infinite, the radii drawn from the centre will be infinite. †1 But the space between infinite radii is infinite: and by the space between the radii I mean the area outside which no magnitude which is in contact with the two lines can be conceived as falling. †2 This, I say, will be infinite: first, because in the case of finite radii it is always finite; and secondly, †3 because in it one can always go on to a width greater than any given width; thus the reasoning which forces us to believe in infinite number, because there is no maximum, applies also to the space between the radii. Now the infinite cannot be traversed, and if the body is infinite the interval between the radii is necessarily infinite: circular motion therefore is an impossibility. [54] Yet our eyes tell us that the heavens revolve in a circle, and by argument also we have determined that there is something to which circular movement belongs.

Lecture 9 (Aquinas' Commentary)

Lecture 9

The need for treating of the infinity of the universe.

94. After explaining the perfection of the universe and pointing out the parts that make it complete, the Philosopher here begins to inquire into its infinity, because, as is said in *Physics* III, some have attributed the notion of "perfect" to the infinite.

Now something can be said to be infinite in three ways: in one way with respect to magnitude; in another with respect to number, and in a third way with respect to duration.

First, then, he asks whether the universe is infinite according to magnitude;

Secondly, whether according to multitude, i.e., whether there is just one world, or an infinitude, or many (L. 16);

Thirdly, whether it is infinite in duration, as though ever existing (L. 22).

About the first he does two things:

First he speaks in a prefatory manner about his intention;

Secondly, he carries out his proposal, at 99.

About the first he does three things:

First he states his intention;

Secondly, he assigns the reason for his intention, at 96;

Thirdly, he decides upon a method of treatment, at 98.

95. He says therefore first [†48] that because it is now clear with respect to the foregoing, namely, that there is no motion contrary to circular motion, and as to the other things mentioned, we must now direct our attention to what remains. And first we must inquire whether there exists any body infinite in act with respect to magnitude, as very many of the early philosophers thought (i.e., all those who posited one material principle, such as fire, or air, or water, or something intermediate); or whether it is impossible that there be a body infinite in act, as was proved in *Physics* III, supposing, however, that there is no body other than the four elements, according to the opinion of others. Since, however, he has just now proved that there is another body besides the four elements, he therefore repeats this consideration in order that the search for the truth may be more universal.

96. Then at [†49] he gives a reason for his intention, from the diversity that happens on account of the aforesaid position. And first he mentions this consequent diversity, and says that it makes no slight difference to the speculation of truth in natural philosophy whether things are this way or that, i.e., whether or not there exists a body that is infinite according to magnitude. Rather, it does make a difference with respect to the whole universe and every natural consideration. For what has just been said, was in the past, and will be in the future, the source of almost all the contradictions between those who have put forth anything about the whole nature of things. For those who posited one infinite principle assumed that all things come to be by a kind of separation from that principle: thus, on account of the infinitude of that principle, they said that the generation of things does not fail. It is as though someone said that from an infinite mass of dough, loaves of bread could be made *ad infinitum*. But those who posited finite principles said that things come to be *ad infinitum* through a reciprocal commingling and separating of the elements.

p 1-42

97. Then at [†50] he assigns the cause why such diversity follows from this: it is because one who makes a slight departure from the truth in his principles gets 10,000 times farther from the truth as he goes on. This is so because all things that follow depend on their principles. This is especially clear in an error at the crossroads: for one who at the beginning is only a slight distance from the right road gets very far away from it later on. And he gives, as an example of what he is talking about, the case of those who posited a smallest magnitude, as Democritus posited indivisible bodies. By thus introducing a least quantity, he overthrew the most important propositions of mathematics — for example, that any given line can be cut into two halves. The reason for this effect is that a principle, though small in stature, is nevertheless great in power, just as from a small seed a mammoth tree is produced. Hence it is that what is small in the beginning becomes multiplied in the end, because it reaches unto all that to which the power of the principle extends, whether this be true or false. Now the infinite has the nature of a principle (for all who have spoken about the infinite considered it a principle, as was said in *Physics* III); besides, the infinite has the greatest force with respect to quantity, because it exceeds every given quantity. If, therefore, a principle which is the least in quantity makes a great difference in what follows from it, then much more is this so of the infinite, which is outstanding not only in virtue of being a principle but also in quantity. Consequently, it is neither inappropriate nor unreasonable that a remarkable difference should follow in natural science from the assumption that some body is infinite. And therefore it must be discussed by resuming our consideration from the principle which we accepted above about the difference between simple and composite bodies.

p 1-42

98. Then at [†51] he points out what order must be followed, and says that of necessity every body is either a member of the simple group or of the composite group. Consequently an infinite body must be one or the other. Again, it is plain that if simple bodies are finite in multitude and magnitude, so too must composite body be — for a composite body has as much quantity as the quantity of the simple bodies of which it is composed. However, it has been shown above that simple bodies are finite in multitude, because there is no body other than the ones mentioned. It remains, therefore, to see whether any of the simple bodies is infinite in magnitude, or whether this is impossible. And this we shall show by first arguing from the first body, i.e., the one that is moved circularly; then we shall consider the remaining bodies, namely, those moved with a straight motion.

p 1-42

99. Then at [†52] he shows that there is not an infinite body:

First with reasons proper to the individual bodies;

Secondly, with three general reasons applying to all, (L. 13).

p 1-42

As to the first he does two things:

First he proves the proposition as to the body moved circularly;

Secondly, as to the bodies moved with a straight motion, (L. 12).

p 1-43

About the first he does two things:

First he proposes his intention and says that it is plain from what will be said that every circularly moved body must be finite (for this is the first of bodies).

p 1-43

100. Then at [†53] he proves his proposition with six arguments, the first of which is this: If any body is infinite, it cannot be moved circularly; but the first body is moved circularly. Therefore, it is not infinite.

p 1-43

First, then, he proves the conditional proposition as follows: If a circularly moved body is infinite, then the straight lines proceeding from its center are infinite, for they are extended as far as the quantity of the body. But the distance between the infinite lines is infinite.

p 1-43

Now someone might say that even if there are infinite lines from the center, yet the distance between them is finite, because every distance is measured according to a straight line, and a finite line can be drawn between two such radii, for example, very close to the center. But it is clear that beyond that line a greater straight line can be drawn between the lines we first mentioned. And therefore he says that he is not speaking of the distance that such lines measure, but that that distance is infinite which is measured by a line beyond which no greater line can be taken, and which touches each of the first lines.

p 1-43

That this distance is infinite he proves in two ways. First, because every such distance between any finite lines proceeding from the center is finite; for the ends of the lines proceeding from the center and of the finite line measuring the greatest distance between them must coincide.

p 1-43

Secondly, he proves the same point because it is possible, if the distance between two measured lines proceeding from the center is given, to take another distance which is greater, just as it is possible to take a number greater than a given number. Hence, just as the infinite is in numbers, so is it in this distance under discussion.

p 1-43

From this he argues as follows: The infinite cannot be traversed, as was proved in *Physics* VI. But if a body be infinite, the distance between the lines proceeding from the center must be infinite, as was proved. But in order that circular motion occur, one line proceeding from the center must reach the position of another. Consequently, it could never happen that anything be moved circularly.

p 1-43

101. Secondly, at [†54] he proves in two ways the destruction of the consequent. First, because it is

evident to sense that the heavens are moved circularly; secondly, because it was proved above by reason that circular motion belongs to some body. What remains, therefore, is that it is impossible for the circularly moved body to be infinite.

Lecture 10 (Aristotle's Text)

272a8-272a20

[55] (2) Again, if from a finite time a finite time be subtracted, what remains must be finite and have a beginning. And if the time of a journey has a beginning, there must be a beginning also of the movement, and consequently also of the distance traversed. This applies universally. Take a line, *ACE,* infinite in one direction, *E,* and another line, *BB,* infinite in both directions. †4 Let *ACE* describe a circle, revolving upon *C* as centre. In its movement it will cut *BB* continuously for a certain time. This will be a finite time, since the total time is finite in which the heavens complete their circular orbit, and consequently the time subtracted from it, during which the one line in its motion cuts the other, is also finite. Therefore there will be a point at which *ACE* began for the first time to cut *BB*. This, however, is impossible. †1 The infinite, then, cannot revolve in a circle; nor could the world, if it were infinite. †2

272a21-272b16

[56] (3) That the infinite cannot move may also be shown as follows. Let *A* be a finite line moving past the finite line, *B.* Of necessity *A* will pass clear of *B* and *B* of *A* at the same moment; for each overlaps the other to precisely the same extent. Now if the two were both moving, and moving in contrary directions, they would pass clear of one another more rapidly; if one were still and the other moving past it, less rapidly; provided that the speed of the latter were the same in both cases. This, however, is clear: that it is impossible to traverse an infinite line in a finite time. Infinite time, then, would be required. (This we demonstrated above in the discussion of movement. †3 And it makes no difference whether a finite is passing by an infinite or an infinite by a finite. For when *A* is passing *B,* then *B* overlaps †1 *A,* and it makes no difference whether *B* is moved or unmoved, except that, if both move, they pass clear of one another more quickly. It is, however, quite possible that a moving line should in certain cases pass one which is stationary quicker than it passes one moving in an opposite direction. One has only to imagine the movement to be slow where both move and much faster where one is stationary. To suppose one line stationary, then, makes no difficulty for our argument, since it is quite possible for *A* to pass *B* at a slower rate when both are moving than when only one is. If, therefore, the time which the finite moving line takes to pass the other is infinite, then necessarily the time occupied by the motion of the infinite past the finite is also infinite. For the infinite to move at all is thus absolutely impossible; since the very smallest movement conceivable must take an infinity of time. Moreover the heavens certainly revolve, and they complete their circular orbit in a finite time; so that they pass round the whole extent of any line within their orbit, such as the finite line *AB.* The revolving body, therefore, cannot be infinite.

Lecture 10 (Aquinas' Commentary)

p 1-44

Lecture 10

The second and third reasons proving the circularly moved body not infinite

p 1-44

102. After setting forth the first argument showing that the circularly moved body is not infinite, on the ground that the distance between two lines proceeding from the center will be infinite and untraversable, the Philosopher now presents the second argument, based on the fact that imaginary lines described in an infinite body, or in its place, cannot intersect.

p 1-44

And in this argument he sets forth the principle that if a finite time is subtracted from a finite time, the remainder will be finite, because part of a finite cannot be infinite; otherwise the whole would be less than the part. And if that remainder of time is finite, it has a beginning, for we say a time is said to be finite, if it has a beginning and end. But it has been demonstrated in *Physics* VI that time and motion and mobile follow one another in respect to being finite or infinite. Hence if the time which measures a *starting out* or motion is finite and has a beginning, then the motion must be finite and have a beginning, and so also must be the magnitude moved. And just as this applies to celestial motion, so too to other motions and mobiles.

p 1-44

103. Having set these things down as principles, he proceeds to demonstrate the proposition. Suppose that, from the center of an infinite body A, there is drawn the line AGE, which is infinite in one direction, namely, toward E; and let that line be revolving with the motion of the whole body, and that, with respect to the point G its motion describes a circle. Let us imagine also, in that imaginary space in which the infinite body is revolved, a certain immobile fixed line BB which does not cross the center but is nevertheless infinite. If then, as has been said, the line AGE by its motion describes a circle from G, i.e., whose radius is AG, it will turn out that the line AGE in making a revolution will cross the entire line BB in finite time. For it is manifest that the radius of a circle cannot be revolved in its circuit without covering or cutting successively the whole fixed immobile line imagined to be in the circle and not passing through the center. And that it is in a finite time that the line drawn from the center cuts the infinite line not passing through the center is manifest from the fact that the whole time in which the heaven is moved is finite, as is evident to our senses. Consequently, a part of that time which is subtracted from the whole time is finite, namely, the time in which AGE falls on line BB. Or rather it follows that that time is finite in which that cutting line is moved to the line which is cut; and this is the time that must be subtracted from all of finite time, so that the remaining time has a beginning, in keeping with the principle enunciated above. It follows, therefore, that the time in which AGE begins to cut BB has a beginning. However, this is impossible, because since it cuts one part before another, then if there is a beginning of the time in which it begins to cut, there would be a beginning in the infinite line, and that is contrary to the notion of infinite.

p 1-44

In this way, then, it is plain that an infinite body cannot be revolved circularly. Hence if the world is infinite, it follows that it is not moved circularly. However, we do observe that the firmament is moved circularly. Hence it is not infinite.

104. The third argument is given at [†56] and is based on the infinity of the whole body which is posited as moving circularly. He says, therefore, that also from what follows it is manifestly impossible for an infinite body to be moved circularly. As a premise he says that if A and B are two finite lines so that A is in motion beside B which is stationary, it follows of necessity that as A moves along it departs from the stationary line B, and conversely that the stationary line B is separated from the moved line A. The reason for this is that each of them overlaps the other to the same extent. But now if both are moved in contrary directions, the lines will separate more quickly. If, however, one is in motion beside the other which is stationary, they will separate more slowly — provided, of course, that they have the same speeds when both are in a separating motion and when one alone is in motion. The reason for presenting this as a premise is that the time in which one line traverses the other is the same as that in which the other traverses it.

After manifesting this point with respect to finite lines, he applies it to the infinite lines he is discussing. And he says that it is manifestly impossible for an infinite line to be traversed by a finite line in finite time. Hence it remains that a finite line traverses an infinite line in infinite time, and this was shown previously in the treatise on motion, i.e., in *Physics* VI. But as appears from what has been said about finite lines, it makes no difference whether it is a finite line being moved through an infinite or an infinite line being moved over a finite, for when an infinite line is being moved through a finite line, the same reasoning holds, whether the finite line is being moved or not. However, it is manifest that if the finite line is being moved as well as the infinite, each traverses the other.

Hence it is manifest that even if the finite line is not being moved, being traversed by the infinite line will be similar to traversing it.

But because he had said that the situation is similar whether the other is moved or not, he now shows wherein there could be a difference: if each of the lines is being moved in a contrary direction, they will separate more swiftly. But this must be understood if the speed is the same, as was said above. For sometimes nothing prevents the line which is being moved next to a stationary one from traversing it more quickly than if it were moved next to a line in contrary motion; for example, when the two lines in contrary motion would have a slow motion, while the one in motion next to the stationary one would have a swift motion. Accordingly, it is no obstacle, so far as the argument is concerned, that the infinite line be moved next to a stationary finite line — since it happens that the moving line A more slowly traverses the moving line B than if the latter were not in motion, provided, of course, that in this second case, while B is stationary, line A is being moved more swiftly.

105. Thus, having shown that it makes no difference whether the infinite line is moved next to a stationary finite line, or whether the finite line is moved against the infinite, he argues from this that if the time in which the finite line traverses the infinite line is infinite, the consequence is that the time in which an infinite line is moved through a finite line is also infinite. Accordingly, it is plainly impossible for an entire infinite body to be moved through an entire infinite space — in which we imagine its motion to occur — in finite time: because if the infinite were moved even through the slightest finite space, it would follow that the time would be infinite — for it has been proved that the infinite is moved through the finite in infinite time, just as the finite through the infinite. But we observe that the heaven circles all its space in finite time. Hence it is manifest that it traverses some finite line in finite time, for example, the line containing within itself the whole circle described about its center, namely, the line AB. Now this would not happen if it were

itself the whole circle described about its center, namely, the line AB. Now this would not happen if it were infinite. It is impossible, therefore, that the circularly moved body be infinite.

Lecture 11 (Aristotle's Text)

272b17-272b24

[57] (4) Again, as a line which has a limit cannot be infinite, or, if it is infinite, is so only in length, †2 so a surface cannot be infinite in that respect in which it has a limit; or, indeed, if it is completely determinate, in any respect whatever. Whether it be a square or a circle or a sphere, it cannot be infinite, any more than a foot-rule can. There is then no such thing as an infinite sphere or square or circle, and where there is no circle there can be no circular movement, and similarly where there is no infinite at all there can be no infinite movement; and from this it follows that, an infinite circle being itself an impossibility, there can be no circular motion of an infinite body.

272b25-272b28

[58] (5) Again, take a centre *C*, an infinite line, *AB*, another infinite line at right angles to it, *E*, and a moving radius, *CD*. †1 *CD* will never cease contact with *E*, but the position will always be something like *CE, CD* cutting *E* at *F*. †2 The infinite line, therefore, refuses to complete the circle. †3

272b29-273a1

[59] (6) Again, if the heaven is infinite and moves in a circle, we shall have to admit that in a finite time it has traversed the infinite. For suppose the fixed heaven infinite, and that which moves within it equal to it. It results that when the infinite body has completed its revolution, it has traversed an infinite equal to itself in a finite time. But that we know to be impossible.

273a2-273a4

[60] (7) It can also be shown, conversely, that if the time of revolution is finite, the area traversed must also be finite; but the area traversed was equal to itself; therefore, it is itself finite. †1

273a5-273a6

We have now shown that the body which moves in a circle is not endless or infinite, but has its limit.

Lecture 11 (Aquinas' Commentary)

Lecture 11

Three additional reasons why the body moving circularly cannot be infinite.

106. Having given three arguments to prove that the body in circular motion cannot be infinite, he now gives a fourth [†47] which is this. It is impossible for a line having an end to be infinite, unless it have an end at one extremity and be infinite at the other. The same is true of a surface: if it has an end at one part, it is not infinite at that part. But when it is limited from every part, it is in no sense infinite. Thus, it is clear that no tetragon, i.e., square, is infinite, nor is a circle which is a plane figure, nor a sphere which is a solid — for these are names of figures, and a figure is something bounded by a terminus or by termini. Thus it is clear that no figured plane is infinite. If, therefore, neither a sphere nor a square nor a circle is infinite, it is clear that there cannot be circular motion that is infinite. For just as there can be no circular motion unless there is a circle, so, if there is no infinite circle, there cannot be an infinite circular motion. But if an infinite body were moved circularly, there would have to be a circular motion that is infinite. Therefore, it is not possible for an infinite body to be moved circularly.

107. The fifth argument is presented at [†58] and it is this. Let G be the center of the infinite body in circular motion. Then through this center let a line AB be drawn which is infinite in both directions; then draw another infinite line not passing through the center but perpendicular to BA at E. Imagine these two lines as stationary in the space in which the infinite body is moved circularly. Draw a third line DG from the center and let it be infinite in the direction of D — for in the direction G it has to be finite. Finally suppose that this third line is in motion by the motion of the body. Because the line E is infinite, it will never be separated from it, because it cannot traverse it, since it is infinite; rather it will always maintain itself as GE, i.e., it will always touch or cut line E just as it cut it in the beginning when it began to be moved — for example, when the line GD was superimposed on the line BA and cut the line E perpendicularly at point E. For in leaving this position it will cut the line E at the point Z, and so it will cut point after point in it; yet it will never be able to be entirely separated from it. It is impossible, however, for the circular motion to be completed, unless the line GD departs from the line E: because before the circular motion can be completed, the line GD will have to traverse that part of the whole that is opposite to the line E. And so it is plain that an infinite line can in no way traverse the circle in such a way that the entire circular motion be completed. Consequently, an infinite body cannot be moved circularly.

108. The sixth argument is presented at [†59] and he forms his argument in two ways. The first is by leading to an impossibility as follows: Suppose, as you say, that the heaven is infinite. Now it is manifest to us that it moves around in finite time — for we see that its revolution is completed in 24 hours. Therefore it will follow that the infinite is traversed in a finite time. This is so because it is necessary to imagine a space equal to the heaven in which the heaven is moved. But we imagine this space as stationary: thus there will have to be an infinite space in which the heaven is moved and a heavenly body equal to the space in which it is moved, because the body must be equal to the space in which it is. If, then, the infinite heaven has been circularly moved in finite time, the consequence is that it traversed the infinite in finite time. But this is impossible, i.e., to traverse the infinite in finite time, as was proved in *Physics* VI. It is, therefore, impossible for an infinite body to be moved circularly.

109. Then at [†60] he forms his argument conversely in order to make it an ostensive proof. And he says that we can say conversely that, from the fact that the time in which the heaven is revolved is finite (as is plain to the senses), it follows that the magnitude traversed is finite. Now it is plain that the space traversed

is equal to the body traversing it. Therefore, the body which is moved circularly is finite.

p 1-48

Therefore he concludes in summary that it is plain that the body which is being moved circularly is not *unterminated,* i.e., it does not lack a terminus as though it were devoid of shape. Consequently, it is not infinite, but has an ending.

Lecture 12 (Aristotle's Text)

273a7-273a21

[61] Further, neither that which moves towards nor that which moves away from the centre can be infinite. [62] For the upward and downward motions are contraries and are therefore motions towards contrary places. But if one of a pair of contraries is determinate, the other must be determinate also. Now the centre is determined; for, from whatever point the body which sinks to the bottom starts its downward motion, it cannot go farther than the centre. The centre, therefore, being determinate, the upper place must also be determinate. But if these two places are determined and finite, the corresponding bodies must also be finite. [63] Further, if up and down are determinate, the intermediate place is also necessarily determinate. For, if it is indeterminate, the movement within it will be infinite †2 and that we have already shown to be an impossibility. †3 The middle region then is determinate, and consequently any body which either is in it, or might be in it, is determinate. [64] But the bodies which move up and down may be in it, since the one moves naturally away from the centre and the other towards it.

273a22-273b26

From this alone it is clear that an infinite body is an impossibility; [65] but there is a further point. If there is no such thing as infinite weight, then it follows that none of these bodies can be infinite. For the supposed infinite body would have to be infinite in weight. (The same argument applies to lightness: for as the one supposition involves infinite weight, so the infinity of the body which rises to the surface involves infinite lightness.) [66] This is proved as follows. Assume the weight to be finite, and take an infinite body, *AB*, of the weight *C*. Subtract from the infinite body a finite mass, *BD,* the weight of which shall be *E*. *E* then is less than *C*, since it is the weight of a lesser mass. †1 Suppose then that the smaller goes into the greater a certain number of times, and take *BF* bearing the same proportion to *BD* which the greater weight bears to the smaller. For you may subtract as much as you please from an infinite. If now the masses are proportionate to the weights, and the lesser weight is that of the lesser mass, the greater must be that of the greater. The weights, therefore, of the finite and of the infinite body are equal. [67] Again, if the weight of a greater body is greater than that of a less, the weight of *GB* will be greater than that of *FB;* and thus the weight of the finite body is greater than that of the infinite. [68] And, further, the weight of unequal masses will be the same, since the infinite and the finite cannot be equal. [69] It does not matter whether the weights are commensurable or not. If *(a)* they are *incommensurable* the same reasoning holds. For instance, suppose *E* multiplied by three is rather more than *C:* the weight of three masses of the full size of *BD* will be greater than *C*. We thus arrive at the same impossibility as before. [70] Again *(b)* we may assume weights which are *commensurate;* for it makes no difference whether we begin with the weight or with the mass. For example, assume the weight *E* to be commensurate with *C*, and take from the infinite mass a part *BD* of weight *E*. Then let a mass *BF* be taken having the same proportion to *BD* which

the two weights have to one another. (For the mass being infinite you may subtract from it as much as you please.) These assumed bodies will be commensurate in mass and in weight alike. [71] Nor again does it make any difference to our demonstration whether the total mass has its weight equally or unequally distributed. For it must always be possible to take from the infinite mass a body of equal weight to *BD* by diminishing or increasing the size of the section to the necessary extent. †1

273b27-274a18

From what we have said, then, it is clear that the weight of the infinite body cannot be finite. It must then be infinite. We have therefore only to show this to be impossible in order to prove an infinite body impossible. [72] But the impossibility of infinite weight can be shown in the following way. [73] A given weight moves a given distance in a given time; a weight which is as great and more moves the same distance in a less time, [74] the times being in inverse proportion to the weights. For instance, if one weight is twice another, it will take half as long over a given movement. [75] Further, a finite weight traverses any finite distance in a finite time. [76] It necessarily follows from this that infinite weight, if there is such a thing, being, on the one hand, as great and more than as great as the finite, †2 will move accordingly, but being, on the other hand, compelled to move in a time inversely proportionate to its greatness, cannot move at all. †3 The time should be less in proportion as the weight is greater. But there is no proportion between the infinite and the finite: proportion can only hold between a less and a greater *finite* time. And though you may say that the time of the movement can be continually diminished, yet there is no minimum. †4 [77] Nor, if there were, would it help us. For some finite body could have been found greater than the given finite in the same proportion which is supposed to hold between the infinite and the given finite; †1 so that an infinite and a finite weight must have traversed an equal distance in equal time. But that is impossible. [78] Again, whatever the time, so long as it is finite, in which the infinite performs the motion, a finite weight must necessarily move a certain finite distance in that same time. Infinite weight is therefore impossible, and the same reasoning applies also to infinite lightness. Bodies then of infinite weight and of infinite lightness are equally impossible.

Lecture 12 (Aquinas' Commentary)

p 1-49

Lecture 12

Various reasons why a body moving in a straight line is not infinite.

p 1-49

110. After showing that the circularly moved body is not infinite, the Philosopher here shows the same for the body moved with a straight motion, whether from the middle [center] or to the middle [center].

p 1-49

First he proposes what he intends and says that just as the circularly moved body cannot be infinite, so, too, the body which is moved with a straight motion, whether from the middle or to the middle, cannot be infinite:

..........,

Secondly, he shows the proposition, at 111, and this

First on the part of the places which are proper to such bodies;

Secondly, on the part of heaviness and lightness, through which such bodies are moved to their proper places, at 114.

p 1-49

About the first he does two things:

First he shows the proposition as to the extreme bodies, of which one is absolutely heavy, namely, earth, and the other absolutely light, namely, fire, at 111;

Secondly, as to the intermediate bodies, which are air and water, 112.

p 1-49

111. He proposes therefore first [†62] that motions of the kind that are up and down, or from the middle and to the middle, are contrary motions. For contrary local motions are ones to contrary places, as has been said, and as was shown in *Physics* V. It remains, therefore, that the proper places to which such bodies are carried are contrary.

p 1-49

Now, we could have at once concluded from this that such places are determinate: for contraries are things which are most distant; but places that are the greatest distance apart are determinate, for the greatest distance is such that none is greater, whereas in infinites a greater and greater distance is always possible. Hence if the places were infinite, contrariety of places would cease. However, Aristotle passes over this argument as manifest and proceeds by another tack. For it is true that if one contrary is determinate, so too the other, because contraries are members of one genus. But the middle of the world which is the midway terminus of a downward motion is determinate — for from whatever part of the heavens something is moved downward (which exists under the upper part facing the heavens) it can travel no farther in its journey from the heavens than the middle: for if it should go beyond the middle, it would now get closer to the heavens and thus would be moved upward. Accordingly, it is clear that the middle place is determinate. It is likewise clear from the aforesaid that the middle having been determined, i.e., the downward place, then the upward place is also necessarily determinate, because they are contraries. And if both are determinate, then the bodies which are apt to be in these places must be finite. Hence it is clear that the extreme bodies subject to straight motion are finite.

p 1-49

112. Then at [†63] he shows the same thing for the intermediate bodies. First he proposes a conditional, namely, that if up and down are determinate, the intermediate place must be determinate. And he proves this with two arguments, the first of which is this: If, when the extremes were determinate, the intermediate should not be determinate, it would follow that a motion from one extreme to the other would be infinite, on account of the infinite intermediate. But that this is impossible has been shown previously in the discussion about circular motion where it was pointed out that motion through the infinite cannot be completed. Consequently, the intermediate place is determinate. Thus, since the thing in place is commensurate with the place, it follows that the body actually existing in this place or that can exist there, is finite.

p 1-50

113. He gives the second argument at [†64] and it is this: A body that is moved up or down can reach the

115. He gives the second argument at [†64] and it is this: A body that is moved up or down can reach the state of existing in such a place. This is clear from the fact that such a body is apt to be moved from the middle or to the middle, i.e., it has a natural inclination to this or that place. Now a natural inclination cannot be in vain, because God and nature do nothing in vain, as was had above. Consequently whatever is naturally moved upward or downward can have its own motion terminated so as to be up or down. But this could not be, if the intermediate place were infinite. Consequently, the intermediate place is finite; so, too, is the body existing in it.

p 1-50

Therefore in summary he concludes from the foregoing that it is clear that no body can be infinite.

p 1-50

114. Then at [†65] he shows that there is no infinite heavy or light body by an argument based on heaviness or lightness. It is this: If a heavy or a light body be infinite, then heaviness or lightness must be infinite. But this is impossible. Therefore, the first supposition [of non-infinity] must be true.

p 1-50

With respect to this, then, he does two things:

First he proves the conditional proposition, at 114;

Secondly, he proves the destruction of the consequent, at 119.

p 1-50

As to the first he does two things:

First he proposes what he intends and says [†65]: If there is no infinite heaviness, none of these, i.e., no heavy body, will be infinite, for the heaviness of an infinite body must be infinite. And the same goes for a light body — for if the heaviness of a heavy body is infinite, the lightness, too, must be infinite, if one supposes some light body carried upward to be infinite.

p 1-50

115. Secondly, at [†66] he proves what he had supposed.

p 1-50

First he presents the proof, at 115;

Secondly, he dismisses some objections, at 116.

p 1-50

First, then, he presents an argument leading to an impossibility [†66] and it is this: If what was said above is not true, then suppose that the heaviness of an infinite body is finite, and let AB be the infinite body and G its finite heaviness. From this infinite body take away a finite part which is the magnitude BD, which is necessarily much less than the whole infinite body. Now the heaviness of this smaller body is less; consequently, the heaviness of BD is less than the heaviness G which is the heaviness of the whole infinite body. Let this lesser heaviness be E. Now let E be a measure of the greater but finite heaviness G — for example, E is a third part of the whole G. Now take from the infinite body a part to be added to the finite body BD, according to the proportion by which G exceeds E, and let this exceeding body be BZ, in such a way that the ratio between the lesser heaviness E to the greater G is the same as that between the body BD and body BZ. That this can be done is proved by the fact that from an infinite body can be taken away as

much as is needed, since, as is said in *Physics* III, the infinite is that whose quantity is such that, as much as is taken away, there always remains something beyond to be taken.

p 1-51

Therefore, with these presuppositions, he now argues to three incompatible consequences. First he reasons in this manner. The ratio of heavy magnitudes is the same as the ratio of their heaviness — for we see that a larger body has more heaviness and a smaller body less. But the ratio of E to G, i.e., of the lesser to the more heavy is the same as that of BD to BZ, i.e., of the smaller body to the larger, as was supposed. Therefore, since E is the heaviness of BD, it will follow that G is the heaviness of the body BZ. But G was assumed to be the heaviness of the whole infinite body. Therefore the numerical value of the heaviness of the finite and of the infinite body will be the same. But this is unacceptable, because it will follow that the whole remainder of the infinity body will have no heaviness. Therefore, the first is impossible, namely, that the heaviness of an infinite body be finite.

p 1-51

Secondly, at [†67] he leads to another unacceptable consequence. For since it is possible to take from an infinite body as much as one wishes, as has been said, let yet another part be taken from the infinite body and added to the body BZ. And let BI be one finite body greater than the finite body BZ. Now the heaviness of the larger body is greater, as was said above. Therefore, the heaviness of BI is greater than the heaviness G which was proved to be the heaviness of the body BZ. But it was assumed in the beginning that G was the heaviness of the whole infinite body. Therefore, the heaviness of a finite body will be greater than that of an infinite body. This is impossible. Therefore, the first is impossible, namely, that the heaviness of an infinite body be finite.

p 1-51

Thirdly, at [†68] he leads to the third incompatibility, namely, that the heaviness of unequal magnitudes would be the same. This clearly follows from the foregoing, because the infinite is not equal to the finite, because it is greater than it. Hence, since these conclusions are impossible, it is impossible for the heaviness of an infinite body to be finite.

p 1-51

116. Then at [†69] he dismisses two objections against the foregoing argument:

First, the first;

Secondly, the second, at 118.

p 1-51

The first objection is that he had supposed in the preceding argument that the lesser heaviness E is a numerical measure of the greater heaviness G. Now this can be denied, for not every greater is measured by a smaller, because a line of 3 hands' length is not a measure of a line of 8 hands' length.

p 1-51

But the Philosopher excludes this objection in two ways. First, because it makes no difference, so far as the conclusion is concerned, whether the two heavinesses, namely, the greater and the less, in question are commensurate, so that the less measures the greater, or not, for the same reasoning holds in either case. For it is necessary that the lesser, taken a certain number of times, either measure or exceed the greater: for example, the product of 2 taken 3 times measures 6 [for 3 times 2 equals 6], while it does not measure 5, but exceeds it. Accordingly, if the heaviness E does not measure the heaviness G, let E be such that 3 times E measures a heaviness greater than the heaviness G. And so in this case the same impossibility as before results, because, if we had taken from the infinite body three magnitudes of quantity BD, the heaviness of

results, because, if we had taken from the infinite body three magnitudes of quantity BD, the heaviness of such a magnitude will be 3 times that of heaviness E, which is assumed to be the heaviness of the body BD. But a heaviness that is 3 times E is greater (according to our assumptions) than the heaviness G which is the heaviness of the infinite body. Wherefore, the same impossibility as before follows, namely, that the heaviness of a finite body exceed that of an infinite body.

p 1-52

117. Secondly, at [†70] he excludes the same objection in another way. And he says that we can assume in the demonstration under discussion that the two heavinesses are commensurate, in such a way that E is commensurate to G. For above we first took from the magnitude a part BD whose heaviness we called E, and this was grounds for saying that E does not measure G. But it makes no difference, so far as the proposition is concerned, whether we begin with the heaviness (by taking any part we want) or with the magnitude so taken. For example, we might begin with the heaviness and take a part of it, namely, E, which measures the whole, namely, G, and then we can take from the infinite body a part BD whose heaviness is E and proceed as above, so that as the heaviness E is to heaviness G, so the magnitude BD is to a greater magnitude BZ. This we can do, because, since the magnitude of the whole body is infinite, as much can be taken from it as we please. By taking the parts of the heaviness and of the magnitude in this way, it will follow that the magnitudes and the heavinesses will be mutually commensurate, i.e., the lesser heaviness will measure the greater, and the smaller magnitude the larger.

p 1-52

118. Then at [†71] he excludes a second objection. For he had supposed that the magnitudes are proportional to the heavinesses. Now this is true in bodies having similar parts, for where there is like heaviness throughout the whole, there must be more heaviness in the larger part. But in a body of unlike parts this is not necessarily so, because the heaviness of a smaller part could be greater than that of a larger part, just as a smaller part of earth is heavier than a larger part of water.

p 1-52

This objection he therefore excludes by saying that it makes no difference to the aforesaid demonstration whether the infinite magnitude in question is homogeneous, i.e., of similar parts, or heterogeneous, i.e., of dissimilar parts. For from an infinite body we can take as much as we wish, either adding or subtracting; hence we can assume certain parts to have a heaviness equal to the part taken first, namely BD, whether the parts taken later are larger or smaller in magnitude. For if we should first take BD as having 3 cubits and having heaviness E, and then take many other parts, for example, of 10 cubits, to make an equal heaviness, it will be the same as if we had taken another equal part having the same heaviness. Consequently, the same impossibility follows.

p 1-52

Therefore, having presented his demonstration and excluded the objections thereto, he concludes from the foregoing that the heaviness of an infinite body cannot be finite. Therefore, it must be infinite. If then, as he will immediately prove, infinite heaviness is impossible, the consequence is that it is impossible for there to be an infinite body.

p 1-53

119. Then at [†72] he proves what he had supposed, namely, that there cannot be infinite heaviness. And in this he destroys the consequent of the previously posited conditional. Concerning this he does two things:

First he proposes what he intends, and says that we must still show from what will follow that infinite heaviness is impossible.

120. Secondly, at [†73] he proves the proposition.

First he lays down certain presuppositions;

Secondly, he uses them in his argument, at 121;

Thirdly, he excludes an objection, at 122.

First, then, he presents three suppositions. The first of these [†73] is that, if *such* a heaviness, i.e., of some certain amount, moves *so much,* i.e., throughout a definite magnitude of space, *in this time,* i.e., a determined time, then necessarily *as much and more,* i.e., a greater heaviness that has as much and something more than a lesser, will move through as great a magnitude in less time — for by as much as a moving power is stronger, by that much is its motion swifter. Consequently, it will traverse an equal distance in less time, as is proved in *Physics* VI.

The second supposition is at [†74] and follows from the first. For if a greater heaviness moves in less time, then the analogy, i.e., proportion between heavinesses and times is the same, but inversely so, i.e., if half the heaviness moves something in a certain amount of time, then double that amount moves in its half, i.e., in half the time.

The third supposition, at [†75], states that a finite heaviness moves through a finite magnitude of space in a certain finite time.

121. Then at [†76] he argues from these premises. If an infinite heaviness should exist, two contradictories will follow: namely, that something would be moved according to it, and not moved. That it would be moved follows, indeed, from the first supposition — for if a certain heaviness moves in a certain amount of time, a greater will move more swiftly, i.e., in less time. Since, therefore, an infinite weight is greater than a finite, then, if a finite moves through a definite distance in a definite time, as the third supposition says, the consequence is that an infinite heaviness will move as much and more, i.e., either through a greater distance in the same time, or through an equal distance in less time, which is to be moved more swiftly.

But that something is not moved according to infinite heaviness follows from the second supposition. For a thing must be moved in proportion to the greatness of the weight in inverse proportion, i.e., the greater weight will move in less time. But there can be no proportion between an infinite and a finite weight, although there is a proportion between less time and more time, provided the time is finite. Consequently, there can be no time given in which an infinite weight can move, but something will always be able to be taken as moved in less time than the time in which an infinite weight moves, for there can be taken no least time in which an infinite weight can move in the sense that it would be impossible for something to be moved in a lesser time. Now the reason why no such least time can be assumed is that since all time is divisible, as is any continuum, it is always possible to take a time smaller than any given time, i.e., a part of the divided time. Consequently, an infinite heaviness cannot exist.

122. Then at [†77] he excludes an objection. For someone could say that there is a least time, namely, an indivisible time, in which the infinite heaviness moves, just as some have posited certain minimum and indivisible magnitudes. But he excludes this objection:

First he shows that an impossibility follows upon assuming a minimum time and that an infinite heaviness moves in that time;

Secondly, he shows that the same impossibility follows if an infinite heaviness should move in any amount of time, even not the minimum, at 123.

p 1-54

He says therefore first [†77] that even if there were a minimum time, it would not help in escaping the impossibility that follows from the assumption of infinite heaviness. For although we posit a minimum time, we do not exclude a ratio of this time to a greater time, for this minimum time will be a part of a greater time, just as one is part of number, which allows it to have a ratio to every number. But an indivisible which is not part of a divisible has no proportion to it, just as a point is not a part of a line and therefore there is no proportion of a point to a line. So let us take another heaviness which is finite and as much heavier proportionally than the finite heaviness that moved something in more time than the infinite heaviness, as the minimum time of the infinite heaviness is less than the greater time of the other finite heaviness. For example, let E be the infinite heaviness, and B the minimum time in which it moves, and let G be the finite heaviness that moves something in more time D than time B. Then let F be the other heaviness which is greater than G in the proportion that D exceeds B. Then, since the lessening of time corresponds to the increasing of heaviness, it will follow that the heaviness F, which is finite, will move something in the same time as the infinite heaviness. But this is impossible.

p 1-54

It should be noted that, just as there is no proportion between a point and a line, so there is none between an instant and time, because an instant is not a part of time. Consequently, the only way Aristotle's argument could be destroyed, would be by positing that an infinite heaviness should move in an instant. But that is impossible, as was proved in *Physics* VI, namely, that any motion should occur in an instant.

p 1-54

123. Then at [†78] he shows that the same impossibility follows in whatever time we assume an infinite heaviness to move. And this is what he says, namely, that if an infinite heaviness should move in any finite time whatever, even though it be not the minimum, it is still necessary that in that time a finite heaviness could move through a finite distance — for one will be able to take an excess of weight corresponding to a lessening of the time, as was said above. Consequently, it is clearly impossible for an infinite heaviness to exist; and the same argument holds for lightness.

Lecture 13 (Aristotle's Text)

274a19-274a29

[79] That there is no infinite body may be shown, as we have shown it, by a detailed consideration of the various cases. [80] But it may also be shown universally, not only by such reasoning as we advanced in our discussion of principles †2(though in that passage we have already determined universally the sense in which the existence of an infinite is to be asserted or denied), but also suitably to our present purpose in the following way. [81] That will lead us to a further question. Even if the total mass is not infinite, it may yet be great enough to admit a plurality of universes. The question might possibly be raised whether there is any obstacle to our believing that there are other universes composed on the pattern of our own, more than one, though stopping short of infinity. First, however, let us treat of the infinite universally.

274a30-274b21

[82] Every body must necessarily be either finite or infinite, and if infinite, either of similar or of dissimilar parts. If its parts are *dissimilar,* they must represent either a finite or an infinite number of kinds. [83] That the kinds cannot be *infinite* is evident, if our original presuppositions remain unchallenged. For the primary movements being finite in number, the kinds of simple body are necessarily also finite, since the movement of a simple body is simple, and the simple movements are finite, and every natural body must always have its proper motion. [84] Now if †1 the infinite body is to be composed of a *finite* number of kinds, then each of its parts must necessarily be infinite in quantity, that is to say, the water, fire, &c., which compose it. But this is impossible, because, as we have already shown, infinite weight and lightness do not exist. [85] Moreover it would be necessary also that their places should be infinite in extent, so that the movements too of all these bodies would be infinite. But this is not possible, if we are to hold to the truth of our original presuppositions and to the view that neither that which moves downward, nor, by the same reasoning, that which moves upward, can prolong its movement to infinity. For it is true in regard to quality, quantity, and place alike that any process of change is impossible which can have no end. I mean that if it is impossible for a thing to have come to be white, or a cubit long, or in Egypt, it is also impossible for it to be in process of coming to be any of these. It is thus impossible for a thing to be moving to a place at which in its motion it can never by any possibility arrive. [86] Again, suppose the body to exist in dispersion, it may be maintained none the less that the total of all these scattered particles, say, of fire, is infinite. †2[87] But body we saw to be that which has extension every way. How can there be several dissimilar elements, each infinite? Each would have to be infinitely extended every way.

274b22-274b28

[88] It is no more conceivable, again, that the infinite should exist as a whole of *similar* parts. For, in the first place, there is no other «straight» movement beyond those mentioned: we must therefore give it one of them. And if so, we shall have to admit either infinite weight or infinite lightness. Nor, secondly, could the body whose movement is circular be infinite, since it is impossible for the infinite to move in a circle. This, indeed, would be as good as saying that the heavens are infinite, which we have shown to be impossible.

274b29-274b32

[89] Moreover, in general, it is impossible that the infinite should move at all. If it did, it would move either naturally or by constraint: and if by constraint, it possesses also a natural motion, that is to say, there is another place, infinite like itself, to which it will move. But that is impossible. †1

Lecture 13 (Aquinas' Commentary)

p 1-55

Lecture 13

A natural and demonstrative argument showing no natural body can be infinite

p 1-55

124. After showing that no single natural body is infinite, the Philosopher here shows by a general argument that no natural body is infinite — for a proof through a common medium causes more perfect science.

p 1-55

About this, therefore, he does two things:

First he mentions his intention;

Secondly, he proves his proposition, at 128.

p 1-55

125. As to the first he does three things:

First he shows (as if summarizing) what has been previously said. And he states that for those who think according to the lines already laid down, it is clear that there is no infinite body, "by a detailed consideration of the various cases," i.e., on account of the reasons applied to the individual parts of the universe, namely, to the body that is moved circularly and to the bodies that are move upward or downward.

p 1-55

126. Secondly, at [†80] he shows what immediately remains to be said. And he says that the same thing can be clear if someone looks at it universally, i.e., by a common medium. And this is in addition to those general arguments given in the book of the *Physics* where the common principles of all natural bodies were discussed — for in *Physics* III is a universal treatment of the infinite, as to how it exists and how not, it being shown there that the infinite exists in potency but not in act. Now, however, the infinite has to be treated in another way, by showing universally that no sensible body can be infinite in act.

p 1-55

127. Thirdly, at [†81] he shows what must be determined immediately after these questions. And he says that after proving what has been proposed, our aim will be to inquire (on the supposition that the whole body of the universe is not infinite) whether the whole body is of such size that there can be made from it several heavens, i.e., many worlds. For perhaps someone could wonder whether it is possible that, just as our world is established about us, there might be other worlds, i.e., more than one though not an infinitude. But before dealing with that question, we shall speak universally of the infinite and show that from

common reasons no body is infinite.

128. Then at [†82] he proves the proposition:

First by natural demonstrative arguments;

Secondly, by logical arguments (L. 15).

Now I call "demonstrative" and "natural" those arguments that are taken from the proper principles of natural science, whose consideration concerns motion, and action and passion which reside in motion, as is said in *Phys*. III.

First, therefore, at [†82] he shows that no body is infinite from the side of local motion, which is the first and most common of motions;

Secondly, universally on the part of action and passion (L. 14).

As to the first he does two things:

First he presents certain divisions, at 129;

Secondly, he examines the members individually, at 130.

129. Therefore he first [†82] presents three divisions: The first of these is that every body must be either finite or infinite. If it is finite, we have our proposition; but if it is infinite, a second division remains, namely, that it be a heterogeneous whole, i.e., having dissimilar parts, as an animal body which is composed of flesh, bones and sinews; or it is a homogeneous whole, i.e., having like parts, such as water, each part of which is water. But if it is a whole of dissimilar parts, a third division remains, namely, whether the species of the parts of such a body are finite or infinite in number. If it is proved that they are not infinite, nor again finite, and further that no body of parts that are alike is infinite, it will have been proved universally that no body is infinite.

130. Then at [†83] he pursues each member. He does three things about this:

First he shows that it is not possible in a body of unlike parts for the species of its parts to be infinite;

Secondly, that it is not possible for an infinite body of unlike parts to be such that the species of its parts be finite, at 131;

Thirdly, he shows that there can be no infinite body having parts that are alike, at 135.

He says therefore first [†83] that it is plainly not possible for an infinite body to be constituted from an infinite species of parts, so long as one is loyal to the "first hypotheses," i.e., the previously made suppositions that there are only three species of simple motion. For if the first motions, i.e. the simple

motions, are finite, then the species of simple bodies must be finite, for the motion of a simple body is itself simple, as was had above. But it was also held above that simple motions are finite: for there are three, namely, motion to the middle, motion from the middle, and motion around the middle. Now the reason why simple bodies are finite, if simple motions are finite, is that every natural body must have its own proper motion — but if there were an infinite species of bodies, while the number of motions was finite, there would have to be some species of bodies without motions, which is impossible.

p 1-56

Consequently, from the fact that simple motions are finite, it is sufficiently proved that the species of simple bodies are finite. Now it is from simple bodies that mixed bodies are composed. Hence, if there were a whole having unlike parts and composed of an infinite species of mixed bodies, the species of the first components would still have to be finite — though it does not even seem possible that mixtures from finite elements should be infinitely diversified. Neither can any compound body be called a mixture of all like parts, because, even if its quantitative parts be specifically alike, as each part of a stone is stone, yet its essential parts are specifically diverse, for the substance of a mixed body is composed of simple bodies.

p 1-56

131. Then at [†84] he shows that it is impossible to have an infinite body of unlike parts, the species of which parts are finite. And he arrives at this with four arguments. The first is that, if a body of unlike parts is infinite and composed of parts that are finite with respect to species, each of the parts would have to be infinite in magnitude. For example, if a mixed body were infinite and composed of elements that were finite, air would have to be infinite, and so would the water and the fire. But this is impossible, because, since each of these is either heavy or light, it would follow according to what was previously said that its heaviness or lightness would be infinite. But it has been proved that no heaviness or lightness can be infinite. Therefore, it is not possible for an infinite body of unlike parts to be composed of a finite species of parts.

p 1-57

However, someone could object that it does not follow from this argument that each of the parts is infinite: for it could be possible for the whole to be infinite if one part were infinite in magnitude and the others finite. But this was rejected in *Physics* III — for if one part were infinite it would consume the other finite parts on account of its excessive power. Likewise it can be said that even in that case the same impossibility will follow, namely, that there would be an infinite heaviness or lightness. And therefore Aristotle was not concerned with it.

p 1-57

132. The second argument is presented at [†85]. For if the parts of an infinite whole were infinite in magnitude, their places would have to be infinite in magnitude, because places are necessarily equal to the things in them. But motion is measured according to the magnitude of the place into which it passes, as is proved in *Physics* VI. Therefore it follows that the motions of all these parts would be infinite. But this is impossible, if what we supposed above is true, namely, that nothing can be moved downward infinitely, nor upward either — because "down" is determinate, since it is the middle, and for the same reason "up" is determinate (for if one contrary is determinate, so is the other).

p 1-57

And he also proves this by what is common to all motions. For in the transmutation according to substance, we see that it is impossible for a thing to *become* what it cannot *be,* as, for example, there cannot be made a rational ass, since it is impossible for an ass to be such. And the same goes for a motion in "such," i.e., with respect to quality and for a motion in "so much," i.e., with respect to quantity, and for a motion in "where," i.e., with respect to place. For if it is impossible for something black ever to have been

made white, as a raven, it is impossible for it ever to become white. And if it is impossible for anything to be a foot long, as an ant, it is impossible for it to be moving toward that; and if it is impossible for something to be in Egypt, as the Danube, it is impossible for it to be moving thither. The reason for this is that nature does nothing in vain. But it would be in vain for a thing to be tending to what is impossible for it to reach. Consequently, it is impossible for a thing to be locally moved to a place where it cannot arrive. But it is impossible to traverse an infinite place. If, therefore, places were infinite, there would be no motion. But since that is impossible, it cannot be that the parts of an infinite body of unlike parts be infinite in magnitude.

p 1-57

133. He presents the third argument at [†86]. For someone could say that there is no infinite continuous unit, but that there are yet certain parts, disconnected and not continued, which are infinite, as Democritus posited infinite indivisible bodies, and as Anaxagoras posited infinite parts all similar to each other.

p 1-57

But Aristotle says that this position leads no less to an impossibility: for if infinite parts of fire are not joined, there is nothing to prevent all of them from joining and thus making one infinite fire from all of them.

p 1-58

134. The fourth argument he presents at [†87]. For when something is said to be infinite, the term should be taken according to its proper meaning. For example, if we say that a line is infinite, we understand it to be infinite in length; while, if we say that a surface is infinite, we understand that it is infinite in length and width. But a body stretches in every direction, because it has three dimensions, as was said above. Consequently, if a body is said to be infinite, it will have to be infinite in every direction, and so in no direction will there be anything outside it. It is therefore not possible that there be in an infinite body many things that are unlike, each of which is infinite, for according to the foregoing it is not possible for there to be a number of infinites.

p 1-58

135. Then at [†88] he shows that there cannot be an infinite body having like parts — and this with two arguments. The first of these is that every natural body must have some local motion; but there is no other except those mentioned above, one of which is around the middle, another from the middle, and a third to the middle. It follows, therefore, that it has one of these. But this is impossible — for if it moves upward or downward, it will be heavy or light, and, consequently, its heaviness or lightness will be infinite, which is impossible according to what has gone before. Likewise it cannot be moved circularly, because it is impossible for the infinite to turn in a circle. For there is no difference between saying this and saying that the heaven is infinite — which is impossible, as was proved above. Therefore a whole infinite body cannot be homogeneous.

p 1-58

136. The second argument is set down at [†89] and it follows from the common notion of local motion. For if there should be an infinite body of parts that are alike, it follows that it cannot be moved at all. If it is moved, it will be moved either according to nature, or by compulsion. But if it has a compulsory motion, then must be a motion natural to it, because a compulsory motion is contrary to a natural motion, as was had above. But if there is a motion natural to it, it follows that there is a place equal to it, into which it is naturally moved, for natural motion belongs to what is moved to its own place. This, however, is impossible, because it would follow that there would be two infinite corporeal places, which is as impossible as that there should be two infinite bodies, for, just as an infinite body is infinite in every direction, so too is an infinite place. Therefore it is not possible for an infinite body to be moved. But if

every natural body is moved, it therefore follows that no natural body is infinite.

p 1-58

It should be noted that this argument applies only to straight motion, for what is moved circularly does not change its place as to subject, but only in conception, as is proved in *Physics* VI. But that an infinite body cannot be moved circularly has already been proved above in many ways.

Lecture 14 (Aristotle's Text)

274b33-274b34

[90] That in general it is impossible for the infinite to be acted upon by the finite or to act upon it may be shown as follows.

275a1-275a13

«1. *The infinite cannot be acted upon by the finite.*» [91] Let A be an infinite, B a finite, C the time of a given movement produced by one in the other. Suppose, then, that A was heated, or impelled, or modified in any way, or caused to undergo any sort of movement whatever, by B in the time C. Let D be less than B; and, assuming that a lesser agent moves a lesser patient in an equal time, call the quantity thus modified by D, E. Then, as D is to B, so is E to some finite quantum. We assume that the alteration of equal by equal takes equal time, and the alteration of less by less or of greater by greater takes the same time, if the quantity of the patient is such as to keep the proportion which obtains between the agents, greater and less. If so, no movement can be caused in the infinite †2 by any finite agent in any time whatever. For a less agent will produce that movement in a less patient in an equal time, and the proportionate equivalent of that patient will be a finite quantity, since no proportion holds between finite and infinite.

275a14-275a23

«2. *The infinite cannot act upon the finite.*» [92] Nor, again, can the infinite produce a movement in the finite in any time whatever. Let A be an infinite, B †1 a finite, C the time of action. In the time C, D will produce that motion in a patient less than B, say F. Then take E, bearing the same proportion to D as the whole BF bears to F. E will produce the motion in BF in the time C. Thus the finite and the infinite effect the same alteration in equal times. But this is impossible; for the assumption is that the greater effects it in a shorter time. It will be the same with any time that can be taken, so that there will be no time in which the infinite can effect this movement. [93] And, as to infinite time, in that nothing can move another or be moved by it. For such time has no limit, while the action and reaction have.

275a24-275b4

«3. *There is no interaction between infinites.*» [94] Nor can infinite be acted upon in any way by infinite. Let A and B be infinites, CD being the time of the action of A upon B. Now the whole B was modified in a certain time, and the part of this infinite, E, cannot be so modified in the same time, since we assume that a less quantity makes the movement in a less time. Let E then, when acted upon by A, complete the movement in the time D. Then, as D is to CD, so is E to some finite part of B. This part will necessarily be moved by A in the time CD. For we suppose that the same agent produces a given effect on a greater and a smaller mass in longer and shorter times, the times and masses varying proportionately. There is thus no

smaller mass in longer and shorter times, the times and masses varying proportionately. There is thus no finite time in which infinites can move one another. Is their time then infinite? No, for infinite time has no end, but the movement communicated has.

275b5-275b11

[95] If therefore every perceptible body possesses the power of acting or of being acted upon, or both of these, it is impossible that an infinite body should be perceptible. [96] All bodies, however, that occupy place are perceptible. There is therefore no infinite body beyond the heaven. Nor again is there anything of limited extent beyond it. And so beyond the heaven there is no body at all. For if you suppose it an object of intelligence, it will be in a place—since place is what 'within' and 'beyond' denote—and therefore an object of perception. But nothing that is not in a place is perceptible. †1

Lecture 14 (Aquinas' Commentary)

p 1-59

Lecture 14

No sensible body is infinite — from action and passion, or motion in common.

p 1-59

137. After showing that a sensible body is not infinite with a reason based on local motion, the Philosopher here shows the same thing with a reason based on action and passion, which follow upon every motion. Concerning this he does two things:

First he demonstrates the proposition;

Secondly, he excludes an objection, at 144.

p 1-59

138. With regard to the first [†90] he gives the following argument: No infinite body has active or passive power or both; but every sensible body has active or passive power or both. Therefore, no sensible body is infinite.

p 1-59

Then with regard to this he does two things:

First he proves the major premise;

Secondly, he presents the minor and conclusion, at 143.

p 1-59

About the first he does two things:

First he proposes what he intends and says that it is clear from what will be said that not only is it impossible for something infinite to be moved locally but that universally it is impossible for something infinite to be acted upon or to act upon a finite body.

p 1-59

Secondly, at [†91] he proves his proposition.

First he shows that the infinite is not acted upon by the finite, 139;

Secondly, that the finite is not acted upon by the infinite, at 140;

Thirdly, that the infinite is not acted upon by the infinite, at 142.

p 1-59

139. He says therefore first [†91] that if an infinite body is acted upon by a finite, let A be an infinite body and B a finite body and, since every motion occurs in time, let G be the time in which B moves or A has been moved. If, therefore, we posit that A, which is the infinite body, is altered by B, which is the finite body, say heated or carried, i.e., moved locally, or affected in any other way, e.g., cooled or moistened, or moved in any way, in time G, let us take one part of the mover B, i.e., a part D (and it makes no difference, so far as the proposition is concerned, if D be some other body less than B). Now it is clear that a smaller body moves a smaller mobile in an equal time (supposing, of course, that there is in the smaller body less power — which must be said, if it is a body of like parts — hence the lesser power moves a smaller body in an equal time). Therefore, let E be a body which is altered or in any other way moved by D in the time G, taking E as a part of the infinite whole A. But since both D and B are finite, and since any two finite bodies are mutually proportionate, then, according to the ratio of D to B, let there be taken the proportion of E to any other larger finite body, for example, F.

p 1-59

Having posited these preliminaries, he makes some suppositions. The first of these is that an altering cause which is equal in magnitude and power will alter an equal body in equal time. A second is that a smaller altering body will alter a smaller in equal time, the result being that one moved body will be less than the other moved body *according to a ratio of something greater to something less,* i.e., in the same proportion that the larger moving body exceeds the smaller moving body.

p 1-60

From these preliminaries, therefore, he concludes that the infinite cannot be moved by any finite in any time. For something less than the infinite will in an equal time be moved by that body which is less than the body moving the infinite; in other words, E, which is less than A, will be moved by D, which is less than B, according to our suppositions. But what is "analogous" to E, i.e., in the same ratio to E, as B to D, is finite, for it cannot be said that A, which is infinite, is to E, as B is to D, because the infinite has no proportion to the finite. Now on the assumption that something finite is to E as B is to D, then commutatively B is to that finite, as D is to E. But D moves E in time G; therefore B moves the finite in time G. But G was the time in which it was supposed that B moved the infinite whole A. Therefore the finite will move a finite and an infinite in the same time.

p 1-60

140. Then at [†92] he proves that an infinite body does not move a finite body in any time.

p 1-60

First he shows that it does not move it in finite time;

Secondly, not in infinite time, at 141.

p 1-60

He says therefore first [†92] that neither will an infinite body move a finite body in any time, namely, determinate time. For if the contrary should be the case, let A be the infinite body, and B or BZ the finite body moved by it, and G the time in which it is being moved. Let D be a finite part of the infinite body A. And because a lesser moves a smaller in equal time, then a finite body D in time G moves Z, a body smaller than B, but a part of B. Now because the whole BZ is proportionate to Z, let it be taken that the whole BZ is to Z, as E is to D, each of which is part of the infinite. Therefore, commutatively, E is to BZ in the same proportion as D is to Z. But D moves Z in time G; therefore E will move BZ in time G. But in time G, BZ was being moved by the infinite body A. It follows, therefore, than an infinite and a finite are altering or somehow moving one and the same mobile in the same amount of time. But this is impossible — for it was supposed above that a greater mover moves an equal mobile in less time, because it moves more swiftly. Consequently, it is impossible for the finite to be moved by the infinite in time G; and the same follows no matter what finite time is taken. Hence there is no finite time possible in which the infinite moves the finite.

p 1-60

141. Then at [†93] he shows that this cannot occur in infinite time. For it is not possible that in an infinite time something shall have moved or shall have been moved — because infinite time has no end, whereas every action or passion does have an end, for nothing acts or is acted upon except in order to reach some end. What remains, therefore, is that an infinite does not move a finite in infinite time.

p 1-60

142. Then at [†94] he proves that the infinite does not move the infinite. And he says that an infinite cannot undergo anything from an infinite with respect to any species of motion at all. Otherwise let A be the infinite body which is acting, and B the infinite body acted upon, and DG the time in which B underwent something from A, and let E be a part of the infinite mobile B. Now, since the entire B has been modified by A in the entire time DG, it is clear that E, which is part of B, was not being moved in this whole time. For we must suppose that a smaller mobile is moved in less time by the same mover — for to the extent that a mobile is more overcome by a mover, the more swiftly is it moved by it. So let E, which is less than B, be moved by A in a time D which is part of the whole time GD. Now D is proportionate to GD, since both are finite. Let us assume, therefore, that E has the same ratio to some larger part of the infinite mobile as D has to GD. Then that finite mobile greater than E must be moved by A in time GD, for we must suppose that a larger and a smaller mobile are moved in more and less time when the same mover is acting, in such a way that the division of the mobiles corresponds to the ratio of the times. Since, therefore, the ratio of that finite to E equals the ratio of the entire time DG to D, then commutatively, we must say that the ratio of the entire time DG to that larger finite mobile is as the ratio of time D to mobile E. But E is moved by A in time D; therefore, that greater finite mobile will be moved by A in time DG. Hence the finite and the infinite will be moved in the same amount of time — which is impossible. And the same impossibility follows whatever be the finite time assumed. Consequently it is impossible for an infinite to be moved by an infinite in finite time.

p 1-61

It remains, therefore, that if it is moved, it is moved in infinite time. But that, too, is impossible, as was proved above, because infinite time has no end, but everything which is moved has an end to its motion — for although the whole motion of the heaven does not have an end, one revolution does. It is therefore plain that the infinite has neither active nor passive power.

143. Then at [†95], assuming the minor premise, he draws the conclusion and says that every sensible body has active or passive power or both. He says "sensible body" here to differentiate from "mathematical body," so that the former means every natural body which, as such, is apt to cause motion or be moved. Thus he concludes that it is impossible for a sensible body to be infinite.

144. Then at [†96] he excludes a certain objection — for someone could say that there is outside the heavens an "intelligible body" which is infinite.

And he says that all bodies in place are sensible. For they are not mathematical bodies, because these do not have place except in a metaphorical sense, as is said in *On Generation* I. Now place is not needed except for motion, as is said in *Physics* IV, and only sensible and natural bodies are subject to motion — for mathematical things are outside of motion. Consequently, it is plain that all bodies in place are sensible.

From this he concludes that there is not an infinite body outside the heaven; and indeed, more universally, that no body exists outside the heaven, either absolutely, i.e., namely, an infinite body, or in a certain respect (or up to a certain point), i.e., a finite body. Since bodies are either finite or infinite, it follows that no body at all exists outside the heaven. For if you should say that this body is intellectual, it will follow that it is in a place on account of your assuming that it is outside the heaven — because "outside" and "within" imply place. Consequently, it follows that if there is a body outside the heaven, then, whether it is finite or infinite, it is sensible, since there is no sensible body which does not exist in a place — for even the heaven is somehow in place, as is plain from *Physics* IV.

So it is manifest according to these words that no intelligible body, finite or infinite, is outside the heaven, because "outside of" signifies place, and nothing is in place except a sensible body. It is also manifest that no infinite sensible body exists outside the heavens, for it was shown above that no sensible body is infinite. But the fact that no sensible finite body exists outside the heavens he does not prove here but supposes it, unless perhaps it is proved by the fact that every sensible body is in a place, and all places are contained within the heavens and determined by the three local motions mentioned above, namely, those around the middle, from the middle, and to the middle.

Lecture 15 (Aristotle's Text)

275b12-275b29

[97] The question may also be examined in the light of more general considerations as follows. The infinite, considered as a whole of similar parts, cannot, on the one hand, move in a circle. For there is no centre of the infinite, and that which moves in a circle moves about the centre. Nor again can the infinite move in a straight line. For there would have to be another place infinite like itself to be the goal of its natural movement and another, equally great, for the goal of its unnatural movement. [98] Moreover, whether its rectilinear movement is natural or constrained, in either case the force which causes its motion will have to be infinite. For infinite force is force of an infinite body, and of an infinite body the force is infinite. So the motive body also will be infinite. (The proof of this is given in our discussion of movement, †2 where it is shown that no finite thing possesses infinite power, and no infinite thing finite power.) If then that which moves naturally can also move unnaturally, there will be two infinites, one which causes, and another which exhibits the latter motion. [99] Again, what is it that moves the infinite? If it moves itself, it must be animate. But how can it possibly be conceived as an infinite animal? And if there is something else that moves it, there will be two infinites, that which moves and that which is moved, differing in their form and power. †3

275b30-276a17

[100] If the whole is not continuous, but exists, as Democritus and Leucippus think, in the form of parts separated by void, there must necessarily be one movement of all the multitude. They are distinguished, we are told, from one another by their figures; but their nature is one, like many pieces of gold separated from one another. But each piece must, as we assert, have the same motion. For a single clod moves to the same place as the whole mass of earth, and a spark to the same place as the whole mass of fire. So that if it be weight that all possess, no body is, strictly speaking, light; and if lightness †1 be universal, none is heavy. [101] Moreover, whatever possesses weight or lightness will have its place either at one of the extremes or in the middle region. But this is impossible while the world is conceived as infinite. [102] And, generally, that which has no centre or extreme limit, no up or down, gives the bodies no place for their motion; and without that movement is impossible. A thing must move either naturally or unnaturally, and the two movements are determined by the proper and alien places. [103] Again, a place in which a thing rests or to which it moves unnaturally, must be the natural place for some other body, as experience shows. Necessarily, therefore, not everything possesses weight or lightness, but some things do and some do not. [104] From these arguments then it is clear that the body of the universe is not infinite.

Lecture 15 (Aquinas' Commentary)

p 1-63
Lecture 15

Logical reasons why no body is infinite.

p 1-63

145. After showing universally with physical reasons, i.e., with arguments taken from facts proper to natural science, that there is no infinite body, the Philosopher here shows the same thing with logical reasons, i.e., arguments taken from certain common principles or from things that are probable but not necessary. And this is what he says [†97]: "It is," i.e., it is possible, "to try," to prove the proposition "more from reason," i.e., more according to the logical mode, "thus," i.e., according to the following arguments. Hence another MS is more plain when it says: "One can argue more logically [i.e., dialectically] as follows."

p 1-63

First he proves the proposition about an infinite continuous body; Secondly, about one that is not continuous, at 150.

p 1-63

146. Concerning the first he does two things:

First he shows that an infinite body of like parts cannot be moved circularly. This he proves on the ground that there is neither a middle nor a boundary in an infinite body. But circular motion is around a middle, as was had above. Therefore, ...

p 1-63

147. Secondly, with three arguments he shows that it is not possible for such an infinite body to be moved with a straight motion. The first of these is this: Every body that is moved with a straight motion can be moved naturally and through force. Now what is moved by force has a place to which it is forcefully moved, and whatever is moved naturally has a place to which it is moved naturally. But every place is equal to the thing in place. Consequently, it will follow that there are two places as large as the infinite body, to one of which it is forcefully moved, and to the other of which naturally. But it is no more possible that there be two infinite places than that there be two infinite bodies, as was had prove. It remains, therefore, that no natural body is infinite.

p 1-63

Both of these reasons are called "logical," because they proceed from what occurs to an infinite body as infinite; whether it be mathematical or natural, namely, to have no middle and nothing equal to it outside of it. Above he posited similar statements, not, however, as principal premises but as assumptions used to manifest other things.

p 1-63

148. The second argument is given at [†98], and is as follows: Whether it be said that an infinite body is moved naturally with straight motion or by force, in either case there must be posited a power moving the infinite body — for it was shown in *Physics* VII and VIII that whatever is moved is moved by another, not only in things that are moved by force (where the principle is more evident), but also in things that are moved naturally, as heavy and light bodies are moved by the generator [or agent producing them], or by whatever removes an obstacle. But since the stronger is not moved by the weaker, it is impossible for an infinite, whose power is infinite, to be moved by the finite power of some mover. Hence it remains that the power of the mover must be infinite.

p 1-64

But it is manifest that if a power is infinite, it will belong to an infinite thing; conversely, if a body is

infinite, its power must be infinite. Therefore, if an infinite body is being moved, then the body moving it must be infinite. For it was proved "in the discussion on motion," i.e., in *Physics* VIII, that no finite thing has infinite virtue, and that no infinite has finite virtue. Consequently, it is plain that if an infinite body is being moved with straight motion, it must be being moved by an infinite body.

p 1-64

Now, if we assume that this infinite body can be moved both according to nature and beside its nature, it will likewise happen, with respect to each motion, that there are two infinites, namely, one that moves thus, i.e., causes natural or compulsory motion, and one that is moved. But this is impossible, namely, that there be two infinite bodies, as was proved above. Therefore, it is not possible for an infinite body to be moved with a straight motion.

p 1-64

This argument is called "logical" because it proceeds from a common property of an infinite body, namely, that it does not have outside it another body equal to it.

p 1-64

It can be concluded from this argument not only that there would be two infinites but more still. For if the infinite body is moved naturally, the body moving it naturally will be infinite; and because it can be moved by force, the body that moves it by force will be infinite. Thus there will be three infinites.

p 1-64

Again, since a motion which is compulsory for one thing, is natural to another, as was stated above, it will follow, too, that there is another infinite body that is moved naturally in the aforesaid way by an infinite power.

p 1-64

149. The third argument he gives at [†99]. And this argument is adduced in order to exclude an objection to the preceding argument. For someone could say that an infinite body is naturally moved not by some other body but by itself, as animals are said to move themselves. Consequently, it will not follow that there are two infinite bodies, as the preceding argument concluded.

p 1-64

And therefore he proposes that it is necessary to say, that if there is an infinite body, whatever moves it is distinct from it. For if it moved itself, it would be animate — for it is proper to animals to move themselves. Consequently if the infinite body should move itself, it will be an infinite animal. But this does not seem possible, because every animal has a definite shape and a definite ratio between its parts and the whole, which factors do not belong to an infinite. Consequently, it cannot be said that the infinite moves itself. But if it be said that something else moves it, it will follow that there are two infinites, namely, the mover and the moved. And from this it follows that they differ in kind and in power: because the mover is related to the mobile as act to potency. But this is impossible, as was previously shown.

p 1-64

150. Then at [†100] he shows that there is no infinite which is non-continuous but distinguished by the interposition of voids, as Democritus and Leucippus posited. This he proves with three arguments. With regard to the first he says that if an infinite is not one continuous whole but is, as Democritus and Leucippus maintain, distinguished by an intermediate void — for they posited that the indivisible bodies cannot be mutually joined without an intervening void — then according to their opinion it follows that for all of them there is one motion. For they said that those infinite indivisible bodies are determined, i.e.,

mutually distinguished, only by their shape, namely, insofar as one is pyramidal, another spherical, another cubic, and so on. Yet they say that all of them are one with respect to their nature, as if, for example, someone said that each of them in isolation had the nature of gold. But if the nature of all is one, then, necessarily, all have one and the same motion in spite of their being the minimal parts of bodies — because the motion of the whole and of the part is the same, as is the motion of the whole earth and one clod, and of all fire and one spark.

p 1-65

Therefore, if all are of the same nature and have the same motion, then all are either moved downward as though having gravity — and thus there will be no body that is absolutely light, since all bodies are said to be composed of these; or else all are moved upward, as though having lightness, and thus no body will be heavy — which is impossible.

p 1-65

151. The second argument, given at [†101], is this: Every heavy body is moved to the middle and every light body to the boundary. If, therefore, some or each of the aforesaid indivisible bodies had heaviness or lightness, it would follow that there would be a boundary and a center of that whole space contained by the indivisible bodies and the intermediate voids. But that is impossible, since all that space is infinite. It remains, therefore, that this position is impossible.

p 1-65

152. And since this argument effectively destroys the infinite howsoever assumed, i.e., whether continuous or non-continuous, he therefore presents this same argument in a more universal way at [†102]. And he says that we can say universally that where there is no middle and no extreme boundary, there is no "up," which is the boundary, and no "down," which is the middle. And if these are removed, there is no place where bodies can be moved with straight motion; for they are moved upward or downward. But if place is removed, there will be no motion — for whatever is moved, must be moved either according to its nature or outside its nature, and this is judged by places that are proper and alien — for natural motions are those in which bodies are moved to their proper places, while compulsory motions are those in which they are moved to alien places. But this is impossible, namely, that motion be taken away from bodies. Therefore, it is impossible to posit an infinite.

p 1-65

153. The third argument is given at [†103]. And he says that the place to which something is moved outside its nature, or in which it rests outside its nature, must be according to nature for something else which is moved to it naturally and rests in it naturally. And this becomes credible by induction: for earth is moved upward outside its nature but fire according to nature; conversely, fire is moved downward outside its nature but earth according to nature. Now we observe certain things being moved downward and others upward. If the things being moved upward are moved outside their nature, we will be obliged to say that there are other things which are moved upward according to nature; likewise, if the things being moved downward are assumed to be moved outside their nature, it is necessary to posit other things that are moved downward according to nature. Hence not all things have heaviness and not all have lightness according to the foregoing position, but those naturally moved downward have heaviness, while those naturally moved upward do not have it.

p 1-65

Finally in summary he concludes [†104] that it is manifest from the foregoing that there is no infinite body at all, i.e., no infinite that is continuous and none that is distinguished by intervals of void.

p 1-65

And these last arguments are called "logical," because they proceed from probabilities not yet completely proved.

Lecture 16 (Aristotle's Text)

276a18-276a21

[105] We must now proceed to explain why there cannot be more than one heaven—the further question mentioned above. †2 For it may be thought that we have not proved universally of bodies that none whatever can exist outside our universe, and that our argument applied only to those of indeterminate extent.

276a22-276b22

[106] Now all things rest and move naturally and by constraint. A thing moves naturally to a place in which it rests without constraint, and rests naturally in a place to which it moves without constraint. On the other hand, a thing moves by constraint to a place in which it rests by constraint, and rests by constraint in a place to which it moves by constraint. Further, if a given movement is due to constraint, its contrary is natural. [107] If, then, it is by constraint that earth moves from a certain place to the centre here, its movement from here to there will be natural, [108] and if earth from there rests here without constraint, its movement hither will be natural. And the natural movement in each case is one. †1 [109] Further, these worlds, being similar in nature to ours, must all be composed of the same bodies as it. Moreover each of the bodies, fire, I mean, and earth and their intermediates, must have the same power as in our world. For if these names are used equivocally, if the identity of name does not rest upon an identity of form in those elements and ours, then the whole to which they belong can only be called a world by equivocation. Clearly, then, one of the bodies will move naturally away from the centre and another towards the centre, since fire must be identical with fire, earth with earth, and so on, as the fragments of each are identical in this world. [110] That this must be the case is evident from the principles laid down in our discussion of the movements; †2 for these are limited in number, and the distinction of the elements depends upon the distinction of the movements. Therefore, since the movements are the same, the elements must also be the same everywhere. [111] The particles of earth, then, in another world move naturally also to our centre and its fire to our circumference. This, however, is impossible, since, if it were true, earth must, in its own world, move upwards, and fire to the centre; in the same way the earth of our world must move naturally away from the centre when it moves towards the centre of another universe. †1 This follows from the supposed juxtaposition of the worlds. For either we must refuse to admit the identical nature of the simple bodies in the various universes, or, admitting this, we must make the centre and the extremity one as suggested. This being so, it follows that there cannot be more worlds than one. †2

276b23-277b25

[112] To postulate a difference of nature in the simple bodies according as they are more or less distant from their proper places is unreasonable. For what difference can it make whether we say that a thing is this distance away or that? One would have to suppose a difference proportionate to the distance and increasing with it, but the form is in fact the same.

Lecture 16 (Aquinas' Commentary)

Lecture 16

Two arguments for one universe, taken from lower bodies.

154. After showing that the universe is not infinite in magnitude, the Philosopher here shows that there are not numerically many worlds, much less an infinitude of them.

First he mentions his intention;

Secondly, he pursues his proposition, at 155.

He says therefore first [†105] that because it has been proved that the body of the whole universe is not infinite, there remains for us to say that it is not possible that there be many heavens, i.e., many worlds: for we had already mentioned above that this was to be discussed.

It should be noted that above the Philosopher mentioned that outside the heavens there is no body either finite or infinite; from which it follows that there is not another world besides it, for that would put a body outside the heavens. Consequently, if it were sufficiently proved above that outside the heavens there exists no body either finite or infinite, nothing would remain to be proved. But if someone does not consider that it was proved for bodies universally, namely, that it is impossible for any of them to be outside the world, but considers that the argument given above refers only to bodies assumed infinite, then, according to this, it still remains to be seen whether it is possible that there be many heavens, i.e., many worlds.

155. Then at [†106] he proves his proposition:

First he shows that there is but one world;

Secondly, he inquires whether it is possible that there be many worlds (L. 19).

As to the first he does two things:

First he shows that there is only one world and takes his argument from the lower bodies, of which everyone supposed the world to consist, at 156;

Secondly, he shows the same with a general argument based on both the lower and the celestial bodies (L. 18).

About the first he does two things:

First he adduces arguments to prove his proposition; Secondly, he proves something he had presupposed

p 1-66

With regard to the first he gives three arguments:

The second one begins at 159;

The third one in Lecture 17.

p 1-66

156. Regarding the first he does two things:

First he presents three suppositions. The first is that all bodies rest and are moved both according to nature and according to compulsion. This of course is true in lower bodies which, since they can be generated and corrupted, can not only be transmuted from their species by the power of a stronger agent, but can be removed from their place by a violent motion or by violent rest. But in celestial bodies, since they are incorruptible, nothing can be violent and outside their nature.

p 1-67

The second supposition is that in whatever place certain bodies remain according to nature and not through compulsion, they are moved thither by nature, and into whatever place things are carried by nature they naturally rest there. And the same is to be said about violence: in whatever place things rest through violence, they are carried to that place by violence; conversely, if they are carried to a place through violence, they are at rest there through violence. The reason for this supposition is that since rest in a place is the end of local motion, the motion must be proportionate to the rest, just as the end is proportionate to the means.

p 1-67

The third supposition is that if any change of place is accomplished by violence to a body, the contrary change is according to nature for that body, as is plain from what was said above.

p 1-67

157. Secondly, at [†107] from these suppositions he argues to his proposition. First on the part of motion. For if there are two worlds, there must be earth in both. Therefore the earth in that other world will be moved to the middle of this world either by nature or by compulsion. If by the latter, we shall have to say, according to the third supposition, that the contrary change of place, i.e., from this world to the middle of that world is natural to it. And this is plainly false, since earth is never naturally moved from the middle of this world. Therefore, the first is also false, namely, that there is more than one world.

p 1-67

158. Secondly, at [†108] he argues to the same on the part of rest. For just as it is plain that the nature of earth does not allow being moved naturally from the middle of this world, so, too, the nature of earth has this quality, that it be naturally at rest in the middle of this world. If then earth brought here from that world remains here not by violence but by nature, it follows, according to the second supposition, that it will be brought from that middle to here according to nature. And this is so because there is but one motion, or one change of place, that is according to nature for earth; hence both motions cannot be natural to earth, namely, from that middle to this or from this to that.

p 1-67

159. Then at [†109] he presents a second argument which excludes a certain defect which someone can

claim in the first argument: for someone could answer to the first that the earth in that world is different in nature from that in this world.

p 1-67

First, then, Aristotle dismisses this at 160; Secondly, from this he argues to his proposition, at 162; Thirdly, he excludes an objection, at 163.

p 1-67

He shows that the earth in the other world is of the same nature as that of this world:

First with an argument taken on the part of the world, at 160;

Secondly, with one based on motion, at 161.

p 1-67

160. He says therefore first [†109] that if the several worlds posited are of a like nature, they must be composed of the same bodies; further, each of those bodies must have the same virtue as the body of this world. Consequently, fire and earth must have the same virtue in each of those worlds, and the same goes for the intermediate bodies, air and water. For if the bodies that are there in another world are spoken of equivocally in relation to the bodies that exist among us in this world and are not according to the same "idea," i.e., not of the same species, the consequence will be that the entire world consisting of such bodies will be only equivocally called a world. For wholes that are composed of parts diverse in species are themselves diverse. But this does not seem to be the intention of those who posit many worlds; rather they use the word "world" univocally. Hence it follows according to their intention that the bodies in these different worlds possess the same virtue. And thus it is manifest that even in those worlds, just as in this, some one of the bodies constituting the world is apt to be moved from the middle, which belongs to fire, and some other to the middle, which belongs to earth, if it is true that all fire is akin in species to all other fire in whatever world it exists, just as the various parts of fire in this world are of one species. And the same holds for the other bodies.

p 1-68

161. Then at [†110] he shows the same thing with an argument taken from motion. And he says that it is manifestly necessary that things be as we have said concerning the uniformity of the bodies which are in the various worlds; and this from the suppositions which are assumed with respect to motions. And he calls "suppositions" the statements which he uses to show the proposition, because here they are being assumed as principles, although some of them have been previously proved. Now one of the suppositions is that motions are finite, i.e., determinate with respect to species; for there are not infinite species of simple motions, but three only, as was proved above. A second supposition is that each of the elements is described in terms of having a natural tendency toward some one of the motions; as earth is described as heavy on account of its tendency to downward motion, and fire light on account of its aptitude for upward motion.

p 1-68

Hence, since the species of motion are determinate, the same specific motions must exist in every world. And because each of the elements is described with respect to some motion, it is further necessary that the elements are specifically the same everywhere, i.e., in each world.

p 1-68

162. Then at [†111] from these premises he argues to the proposition. For if the bodies in every world are of the same species, and we see that all the parts of earth in this world are carried to the middle of this

world, and all parts of fire to its boundary, then the consequence will be that also all the parts of earth in any other world are moved to the middle of this world, and all the parts of fire in any other world to the boundary of this world. But this is impossible. For if this should happen, the earth in another world would have to be carried upward in its own world and fire in that world would have to be carried to its middle. Similarly, the earth in this world would be naturally carried from the center of this world to the center of that world.

p 1-68

And this must follow on account of the disposition of the worlds which have such a position that the middle of one world is at a distance from the middle of another; consequently, earth cannot be moved to the middle of another world without leaving the middle of its own world and moving to the boundary, which is to be moved upward. Likewise, because the boundaries of various worlds have different positions, then if fire is to be carried to the boundary of another world, it must leave the boundary of its own world, which is to be moved downward in its own world. But all these things are untenable — for either we must posit that the natures of the simple bodies are not the same in the several worlds (which was disproved above), or, if we say that they are of the same nature and wish to avoid the aforesaid inconsistencies which follow upon a diversity of middles and boundaries, we must admit but one middle to which all heavy bodies, wherever they are, are moved, and one boundary to which are moved all light things wherever they be. On this assumption, it is impossible that there be many worlds, because one middle and one boundary imply one circle or sphere.

p 1-69

163. Then at [†112] he excludes an objection, since someone could say that the bodies in another world are not moved to the center and boundaries of this world on account of the distance.

p 1-69

But he rejects this and says that it is unreasonable to accept the postulate that the natures of simple bodies vary on the ground of their being more or less distant from their places, so as to be moved to their places when they are near but not when they are far away. For it does not seem to make any difference to the nature of the body whether it is this far or that far from its place, because mathematical differences do not vary the nature. For it is according to reason that the closer a body gets to its place the more swiftly is it moved, but yet the species of its motion and of the mobile are not varied. For a difference in velocity is according to quantity, not according to species, just as is a difference in length.

Lecture 17 (Aristotle's Text)

276b26-277a12

[113] Moreover, the bodies must have some movement, since the fact that they move is quite evident.†3 Are we to say then that all their movements, even those which are mutually contrary, are due to constraint? No, for a body which has no natural movement at all cannot be moved by constraint. If then the bodies have a natural movement, the movement of the particular instances of each form must necessarily have for goal a place numerically one, i.e. a particular centre or a particular extremity. [114] If it be suggested that the goal in each case is one in form but numerically more than one, on the analogy of particulars which are many though each undifferentiated in form, we reply that the variety of goal cannot be limited to this portion or that but must extend to all alike. †1 For all are equally undifferentiated in form, but any one is different numerically from any other. What I mean is this: if the portions in this world behave similarly both to one another and to those in another world, then the portion which is taken hence will not behave differently either from the portions in another world or from those in the same world, but similarly to them, since in form no portion differs from another. [115] The result is that we must either abandon our present assumptions or assert that the centre and the extremity are each numerically one. But this being so, the heaven, by the same evidence and the same necessary inferences, must be one only and no more.

277a13-277a27

[116] A consideration of the other kinds of movement also makes it plain that there is some point to which earth and fire move naturally. [117] For in general that which is moved changes from something into something, the starting-point and the goal being different in form, and always it is a finite change. †2 For instance, to recover health is to change from disease to health, to increase is to change from smallness to greatness. Locomotion must be similar: for it also has its goal and starting-point—and therefore the starting-point and the goal of the natural movement must differ in form—just as the movement of coming to health does not take any direction which chance or the wishes of the mover may select.†1 Thus, too, fire and earth move not to infinity but to opposite points; and since the opposition in place is between above and below, these will be the limits of their movement. †2[118] (Even in circular movement there is a sort of opposition between the ends of the diameter, though the movement as a whole has no contrary: so that here too the movement has in a sense an opposed and finite goal.) There must therefore be some end to locomotion: it cannot continue to infinity.

277a28-227a34

[119] This conclusion that local movement is not continued to infinity is corroborated by the fact that earth moves more quickly the nearer it is to the centre, and fire the nearer it is to the upper place. But if movement were infinite, speed would be infinite also; and if speed then weight and lightness. For as superior speed in downward movement implies superior weight, so infinite increase of weight necessitates infinite increase of speed. †3

Lecture 17 (Aquinas' Commentary)

Lecture 17

A third argument from lower bodies. Natural bodies have determinate places.

164. Having given two arguments showing that the world is one, Aristotle here gives a third argument for the same. And this argument adds something which seemed to be lacking in the first argument. For someone could say that it is not inherent in bodies to be naturally moved to certain definite places, or, if they are moved to definite places, those that are one in species and diverse in number are moved to numerically diverse places, which agree in species. But they are not moved to the same numerical place as the first argument supposed. Therefore, in order to make these things sure, Aristotle adduces this third argument. With respect to this he does three things:

First he gives the argument, at 165;

Secondly, he excludes an objection, at 166;

Thirdly, he infers the main conclusion, at 169.

165. He says therefore first [†113] that the above-mentioned bodies must have some motion. For it is manifest that they are moved — this, indeed, is evident to sense and to reason, because such are natural bodies, i.e., bodies which it befits to be moved. Therefore there can remain the doubt whether it is to be said that natural bodies are moved violently with all the motions with which they are moved, even if they are contrary motions — for example, that fire is moved both upward and downward by compulsion. But this is impossible, because what is not apt to be moved at all, i.e., what of its nature has no motion cannot be moved by compulsion. For we say that a thing suffers compulsion if it is removed from its proper inclination by the force of a stronger agent. If, therefore, there is not a natural inclination to certain motions in bodies, compulsion has no place in them — any more than blindness would be attributed to an animal if it had no capacity to see. Consequently, we must admit that those bodies which are parts of the world have a motion according to nature, and among the bodies having a nature, the motion is one. Now motion is called "one" inasmuch as it is to one terminus, as is plain in *Physics* V. Therefore the motion of each thing belonging to the same species must be to one numerical place: namely, if they are heavy, it is to the middle, which is of this world; if they are light, it is to the boundary which is of this world. And upon this it follows that there is one world.

166. Then at [†114] he excludes an objection. For someone could say that all bodies having the same natural motion are moved to places that are the same in species, but several numerically — since even the singulars, i.e., the individual parts of one natural body, e.g., earth or water, are numerically many but do not differ in species. But oneness of nature in the mobiles that are of the same species does not seem to require any more than that their motion be one in species; in keeping with this, it would seem to be enough if the places at which the motion is terminated were alike in species.

167. But in order to exclude this he says that such an accident, namely, being moved to the same specific places, does not seem to be congruent to one set of parts and not to another (i.e., such that some parts alike in species would be moved to the same numerical place and others to the same specific place); rather it

should be congruent to all alike (i.e., either all the parts alike in species be moved to the same numerical place, or all such parts be moved to one place specifically similar but numerically different) — for all such parts are alike in not differing specifically, but each differs from the other numerically. The reason he says this is that the parts of any body, for example, earth, which are in this world are similarly related both to the parts of earth in this world and to the parts in another world, since earth here and earth there are specifically the same. If, then, a part, e.g., of earth, be taken hence, i.e., from this world, it makes no difference whether it is compared to parts in some other world or to parts in this world; rather the relationships are the same in both cases. For the parts of earth in this world and those in some other world do not differ in species. And the same holds for other bodies. But we see that all parts of earth in this world are moved to one numerical place; similarly for other bodies. Therefore all the parts of earth in whatever world they exist are naturally moved to this middle of this world.

p 1-71

168. Therefore the very natural inclination of all heavy bodies to one numerical middle, and of all light bodies to numerically one boundary, manifests the unity of the world. For it cannot be said that in the many worlds, bodies would be arranged according to diverse middles and boundaries, as happens in the case of men in whom the centers and boundaries are numerically diverse but specifically the same. For the nature of man's members or those of any other animal is not determined with respect to their relationship to some place but rather with respect to their relationship to some act; indeed, the position occupied by the parts of animals is in keeping with a suitable operation of the members. But the nature of heavy and of light things is determined to definite places, such that all having the same nature also have numerically one natural inclination to numerically one place.

p 1-71

169. Then at [†115] he infers the principal conclusion. For when a conclusion according to due form is inferred from premises, either the conclusion must be concluded or the premises denied. He concludes, therefore, that either it is necessary to deny these suppositions, i.e., the principles from which he concluded the proposition, or to concede the conclusion, namely, that there is one middle to which all heavy things are moved, and one boundary to which all light things are carried. If this is true, then it is necessary as a consequence that there be one heaven, i.e., one world and not several, and this on account of the above-given "arguments," i.e., signs and "necessities," i.e., necessary arguments.

p 1-71

170. Then at [†116] he proves something he had assumed, namely, that natural bodies have definite places to which they are naturally borne.

p 1-71

First he proves the proposition;

Secondly, he rejects a contrary opinion (L. 18).

p 1-71

About the first he does two things:

First he shows the proposition by a natural argument;

Secondly, by a sign, at 173.

p 1-71

As to the first he does three things:

First he proposes what he intends, and says it is clear from other arguments than the foregoing — or even from other motions — that there is a definite place whither earth is naturally borne. And the same is to be said of water and of any of the other bodies.

p 1-72

171. Secondly, at [†117] he gives his argument, saying that entirely, i.e., universally, this is true, that whatever is moved is changed from something determinate to something determinate: for it is said in *Physics* I that something white comes to be, not from any non-white at random, but from black. Now these two factors, namely, that from which a motion proceeds, and that into which it is terminated, differ in species — for they are contrary, as is plain in *Physics* V; but contrariety is a difference respecting form, as is said in *Metaphysics* X.

p 1-72

He proves what he has said by the fact that every change is finite, as was proved in *Physics* VI, and also by the facts cited above, namely, that nothing is moved to what it cannot attain; but nothing can attain to the infinite; hence every change must be finite. But if there were not something definite toward which a motion tends and something specifically different from that, at which it begins, the motion would have to be infinite; for there would be no reason why the motion should end here rather than elsewhere, but, for the same reason that it began to be moved thence, it would also begin to be moved hence.

p 1-72

He also explains what was said, by an example. For what is healed is moved from sickness to health; what is increased is moved from small to large. Hence, too, what is carried, i.e., moved according to place, is moved from something definite to something definite, and these are the place at which a motion begins, and the place to which it tends. Consequently, there must be a specific difference between the place from which something is locally moved and the place into which it is naturally borne, just as what is healed does not tend to just anything at random, as though by chance, or solely according to the will of the mover, but to something definite, to which it is inclined by nature. In the same way, therefore, fire and earth and other natural bodies are not borne *ad infinitum,* i.e., to something indefinite, as Democritus held; rather they are borne to places opposite to those in which they previously found themselves. But "up" is contrary to "down" in the realm of place. It follows, therefore, that "up" and "down" are the termini of the natural motions of simple bodies.

p 1-72

172. Then at [†118] he excludes an objection by which someone could object that circular motion does not seem to be from opposite to opposite, but more from the same to the same.

p 1-72

But he says that even circular motion somehow involves opposition of termini. He says "somehow" for two reasons. First, because opposition in circular motion is not found with respect to points designated on the circle insofar as they are points of the circle, but only insofar as they are the extremities of the diameter — on the basis of which a maximum distance is reckoned in a circle, as was said above. Hence he adds: "What are according to the diameter," i.e., the extremities of the diameter, "are opposite." Secondly, because just as the whole spherical body does not change place as to subject but only in conception, although the parts change their place even as to subject, so also, if the entire circular motion is taken, there is no opposition in termini, except conceptually, namely, in the sense that the same [point], from which and to which circular motion is, is taken now as the beginning and now as the end. But if we take the parts of circular motion, we find opposition with respect to a straight line, as has been said. And therefore he adds that there is nothing contrary to a whole revolution. Consequently, it is plain that even in things circularly

moved, the change is in a certain way toward things opposite and determinate.

p 1-73

Thus he concludes universally to what he intended, namely, that there is necessarily an end involved in local motion and that a natural body is not moved *in infinitum* [i.e., to nothing definite], as Democritus posited about the motion of atoms.

p 1-73

173. Then at [†119] he proves the same thing through a sign. This proof he calls an "argument" in the sense that it is, so to speak, conjectural. And he says that the argument for claiming that a natural body is not moved to infinity but to something certain is that earth, the closer it approaches the middle, the more swiftly it is moved (which can be perceived from its greater impetus, namely, as something is more strongly impelled by the heavy in its fall as it nears the terminus of its motion); and the same holds for fire whose motion is swifter, the closer it approaches an upward place. If, therefore, earth or fire were moved to infinity, their speed could increase indefinitely.

p 1-73

And from this he concludes that the heaviness or lightness of a natural body could be increased infinitely. For just as the speed of a heavy body is greater according as the heavy body descends farther (and a heavy body is swift on account of its heaviness), so, too, an indefinite addition could be made to the speed if an infinite addition were made to heaviness or lightness. But it was shown above that there cannot be an infinite heaviness or lightness, and that nothing can be moved toward what it cannot attain. Consequently, addition of heaviness *ad infinitum* cannot occur, and, as a result, neither can addition of speed. Hence neither can the motion of natural bodies be tending toward what is infinite.

p 1-73

174. It should be noted that the cause of this accident that earth is moved more swiftly the more it descends was explained by Hipparchus in terms of an agent causing motion by compulsion. The farther the motion is from such an agent the less remains of that agent's power, so that the motion becomes slower. Hence in the beginning, a compulsory motion is intense but in the end it is weakened, until finally the heavy body can no longer be borne upward, but begins to be moved downward due to the small amount of the agent's virtue that remains, which, the less it becomes, so much the swifter becomes the contrary motion.

p 1-73

But this explanation is applicable only to things that are moved naturally after a compulsory motion; it does not apply to things that are moved naturally on account of being generated outside their proper places.

p 1-73

Others explained this phenomenon in terms of the amount of the medium through which the motion takes place (for example, the amount of air): in such a motion, if it is natural, the farther a thing has been moved, the less is the amount remaining — and, therefore, the less is it able to impede a natural motion. But this explanation also, applies no less to compulsory motions than to natural motions, in which, nevertheless, the contrary happens, as will be said below.

p 1-73

Therefore, it must be said with Aristotle that the cause of this phenomenon is that, to the extent that a heavy body descends more, to that extent is its heaviness the more strengthened on account of its proximity to its proper place. And therefore he argues that if the speed increased infinitely, the heaviness, too, would increase indefinitely. And the same holds for lightness.

Lecture 18 (Aristotle's Text)

277b1-277b7

[120] Further, it is not the action of another body that makes one of these bodies move up and the other down; nor is it constraint, like the 'extrusion' of some writers. †4[121] For in that case the larger the mass of fire or earth the slower would be the upward or downward movement; but the fact is the reverse: the greater the mass of fire or earth the quicker always is its movement towards its own place. [122] Again, the speed of the movement would not increase towards the end if it were due to constraint or extrusion; for a constrained movement always diminishes in speed as the source of constraint becomes more distant, [123] and a body moves without constraint to the place whence it was moved by constraint.

277b8-277b13

A consideration of these points, then, gives adequate assurance of the truth of our contentions. [124] The same could also be shown with the aid of the discussions which fall under First Philosophy, †1 as well as from the nature of the circular movement, which must be eternal both here and in the other worlds. [125] It is plain, too, from the following considerations that the universe must be one.

277b14-277b23

The bodily elements are three, and therefore the places of the elements will be three also; the place, first, of the body which sinks to the bottom, namely the region about the centre; the place, secondly, of the revolving body, namely the outermost place, and thirdly, the intermediate place, belonging to the intermediate body. Here in this third place will be the body which rises to the surface; since, if not here, it will be elsewhere, and it cannot be elsewhere: for we have two bodies, one weightless, one endowed with weight, and below is the place of the body endowed with weight, since the region about the centre has been given to the heavy body. And its position cannot be unnatural to it, for it would have to be natural to something else, and there is nothing else. It must then occupy the intermediate place. What distinctions there are within the intermediate itself we will explain later on.

277b24-277b26

[126] We have now said enough to make plain the character and number of the bodily elements, the place of each, and further, in general, how many in number the various places are.

Lecture 18 (Aquinas' Commentary)

Lecture 18

Exclusion of the opinion that natural bodies are not moved naturally to determined places. Unity of the world from higher bodies.

175. After showing that natural bodies are by nature moved to definite places, the Philosopher here excludes a contrary opinion.

First he proposes what he intends;

Secondly, he proves his proposition, at 176.

Now, since truth is established by excluding falsehood, the Philosopher here induces the exclusion of an error as a certain demonstration of the truth. He says, therefore, that what has been said is manifested by the fact that natural bodies are not borne upward and downward as though moved by some external agent.

By this is to be understood that he rejects an external mover which would move these bodies *per se* after they obtained their specific form. For light things are indeed moved upward, and heavy bodies downward, by the generator inasmuch as it gives them the form upon which such motion follows, but they are moved *per accidens*, and not *per se*, by whatever removes an obstacle to their motion. However, some have claimed that after bodies of this kind have received their form, they need to be moved *per se* by something extrinsic. It is this claim that the Philosopher rejects here.

Neither should it be said that these bodies are moved by compulsion, which is the opinion of those who said that they are moved by a certain "extrusion," in the sense that one body is displaced by another, stronger, one. For they assumed that there was one motion natural to all bodies, but since some are given momentum by others, it comes to pass that a certain number are moved upward and a certain number downward.

176. Then at [†121] he proves his proposition with three arguments. The first of these is adduced mainly to show that bodies of this kind in their natural motions are not moved by external movers. For it is clear that a motion is slower to the extent that the mover overcomes the mobile less. But a given virtue of the mover overcomes a larger mobile less than a smaller.

If, then, these bodies were moved by an external mover, a greater amount of fire would be moved upward more slowly and a larger amount of earth downward more slowly. But just the opposite happens, for a greater quantity of fire and a greater quantity of earth are moved more swiftly to their places. This gives us to understand that these bodies have the principles of their motion within themselves, and their motive powers are greater according as the bodies are greater, and that is why they are moved more swiftly. Consequently, it is plain that such bodies in their natural motions are not moved by an exterior power but by an intrinsic one, which they have received from their generator.

177. At [†122] he gives a second argument which is adduced mainly to show that motion of these bodies is not through compulsion. For we see that all things moved by compulsion are moved more slowly according as their distance from the mover increases, as is plain in projectiles, whose motion slackens near the end and finally fails. If, then, heavy and light bodies were moved by compulsion as though mutually pushing one another, it would follow that their motion toward their proper places would not be faster but slower in the end. But the contrary of this is plain to our senses.

178. He gives at [†123] the third argument which can regard both. For we see that no body is moved by violence to a place whence it can be removed by violence. For it is because a body is apt to be in a certain place that it can be moved thence by violence; hence it was originally brought there naturally and not by violence. If, therefore, it is assumed that some motions of heavy and light bodies are violent by which they are moved from certain places, it cannot be said that the contrary motions which brought them there are violent. Thus it is not true that all the motions of these bodies are caused by another and by violence.

He concludes from the foregoing, in summary, that speculation on these points will testify to the truth of what has been said.

179. Then at [†124] he shows through the higher bodies which are moved circularly that the world is one:

First in a special way by the higher bodies;

Secondly, in a general way by the higher and the lower, at 181.

He says therefore first [†124] that there is still another way of proving that there is but one world, by arguments taken from first philosophy, i.e., by using what has been determined in the *Metaphysics,* and from what has been shown in *Physics* VIII, namely, that circular motion is eternal, which, both in this and in other worlds, has a natural necessity. For the Philosopher concluded to the eternity of celestial motion in *Physics* VIII by considering the order between mobiles and movers, which must be similar in any world, if "world" is taken univocally. Now if celestial motion is eternal, it must be moved by an infinite power, such as cannot exist in a magnitude, as was proved in *Physics* VIII. Such a power is non-material and consequently numerically one, since it is a form and species only, whereas it is through matter that individuals are multiplied in the same species. Consequently, the power that moves the heavens must be numerically one. Hence the heavens too must be numerically one, and, consequently, the whole world.

180. But someone can say that this argument does not conclude with necessity. For the first mover moves the heaven as that which is desired, as is said in *Metaphysics* XII. But there is nothing to prevent the same thing from being desired by many. So it seems that we cannot from the unity of the first mover conclude necessarily to the unity of the heavens.

But it must be said that many can desire one thing, but not indeed in an identical way, since an absolute multitude is not joined immediately to one thing that is first; but many things can desire one thing according to a certain order, some being closer and some more remote, the coordination of which to one ultimate

objective makes the unity of the world.

p 1-75

181. Then at [†125] he proves his proposition with an argument taken generally from higher and lower bodies. And he says that even the following consideration will show that it is necessary for the heaven, i.e., the world, to be one. To prove this he assumes that, just as there are three bodily elements, namely, heaven and earth and an intermediate, so there are three places corresponding to them: one is the place about the middle, that of the subsisting body, i.e., the place of the heaviest body which supports all, namely, earth; another is the place which is the highest in altitude, that of the circularly moved body; the third place is intermediate and corresponds to the intermediate body.

p 1-76

With regard to these words it should be noted that Aristotle here reckons the heaven among the elements, although an element is something out of which things are composed, as is said in *Metaphysics* V.

p 1-76

However the heaven, even though it does not enter into the composition of a mixed body enters into the composition of the whole universe, as being a part of it. Or he is using the word "element" in a wide sense to designate any of the simple bodies which he calls "bodily elements" to distinguish them from prime matter, which, though an element, is not a bodily element, for considered in itself it is without any form.

p 1-76

Secondly, we should consider his statement that there are three places. Now since place is the boundary of a containing body, as is said in *Physics* IV, it can be clear what the place of the intermediate element is — for it is the surface of the supreme body containing it. How the first body is in place has been explained in *Physics* IV. But how the middle [i.e., the center], which seems to be not a container but a contained, is the place of the heavy body seems to offer difficulty.

p 1-76

But it should be said that, as has been said in *Physics* IV, the surface of the containing body does not have the notion of place because it is the surface of such a body but with respect to the position it has in relation to the first container accordingly, namely, as it is nearer or farther from it. Now the heavy body in its nature is at a maximum distance from the celestial body on account of its materiality; therefore there is due it a place farthest from the first container and nearest to the middle. Consequently the surface containing the heavy body is called its place according to its nearness to the center. Hence he said advisedly that the place located around the middle is the place of the subsisting body.

p 1-76

182. From what has been set forth he goes on to prove his proposition from a light body, just as above he had proceeded from a heavy body. For it is necessary that a light body which is borne upwards be in this intermediate place: because, since every body is in some place, if the light body were not in this intermediate place, it would be outside it. But that is impossible, because outside this intermediate place there is, on the one side, celestial body which has no heaviness or lightness, and on the other side, terrestrial body which has heaviness. Now it cannot be said that there is a place more downward than the place of the body having heaviness, because the place about the middle is proper to it. But from this it is plainly impossible for another world to exist, because some light body would have to be there and thus, if that world were above this world, a light body would exist above the place of the heavens; if that world were below this world, a light body would be below the place of the heavy body — which is impossible.

p 1-76

183. But to this argument someone could object that the light body would be outside this intermediate place not according to nature but outside its nature.

p 1-77

To exclude this he adds that not even outside its nature can a light body be outside this intermediate place. Because every place that is outside nature for some body is according to nature for some other body. For neither God nor nature has made any place in vain, i.e., a place in which no body is apt to be. Now, no other body is found in nature except the three mentioned and to which the aforesaid places are deputed, as is plain from what has been said. Hence neither according to nature nor beside nature can a light body exist outside this intermediate place. Consequently, it is impossible that there be many worlds.

p 1-77

Since he had spoken of an intermediate element as if it were one certain body, he adds that later, i.e., in the third and fourth books, he will speak about the differences in that intermediate. For it is divided into fire, air and water, which is also light in relation to earth.

p 1-77

Finally in summary he concludes that from the foregoing it is manifest about the bodily elements, which and how many they are, and what is the place of each of them and, in general, how many bodily places exist.

Lecture 19 (Aristotle's Text)

277b27-278a16

[127] We must show not only that the heaven is one, †2 but also that more than one heaven is impossible, and, further, that, as exempt from decay and generation, the heaven is eternal. We may begin by raising a difficulty. [128] From one point of view it might seem impossible that the heaven should be one and unique, †1 since in all formations and products whether of nature or of art we can distinguish the shape in itself and the shape in combination with matter. For instance the form of the sphere is one thing and the gold or bronze sphere another; the shape of the circle again is one thing, the bronze or wooden circle another. For when we state the essential nature of the sphere or circle we do not include in the formula gold or bronze, because they do not belong to the essence, but if we are speaking of the copper or gold sphere we do include them. We still make the distinction even if we cannot conceive or apprehend any other example beside the particular thing. This may, of course, sometimes be the case: it might be, for instance, that only one circle could be found; yet none the less the difference will remain between the being of circle and of this particular circle, the one being form, the other form in matter, i.e. a particular thing. [129] Now since the universe is perceptible it must be regarded as a particular; for everything that is perceptible subsists, as we know, in matter. [130] But if it is a particular, there will be a distinction between the being of 'this universe' and of 'universe' unqualified. There is a difference, then, between 'this universe' and simple 'universe'; the second is form and shape, the first form in combination with matter; [131] and any shape or form has, or may have, more than one particular instance.

278a17-278a22

[132] On the supposition of Forms such as some assert, this must be the case, and equally on the view that no such entity has a separate existence. For in every case in which the essence is in matter it is a fact of observation that the particulars of like form are several or infinite in number. [133] Hence there either are, or may be, more heavens than one. †1 On these grounds, then, it might be inferred either that there are or that there might be several heavens. [134] We must, however, return and ask how much of this argument is correct and how much not.

278a23-278b7

Now it is quite right to say that the formula of the shape apart from the matter must be different from that of the shape in the matter, and we may allow this to be true. We are not, however, therefore compelled to assert a plurality of worlds. Such a plurality is in fact impossible if this world contains the entirety of matter, as in fact it does. [135] But perhaps our contention can be made clearer in this way. Suppose 'aquilinity' to be curvature in the nose or flesh, and flesh to be the matter of aquilinity. Suppose, further, that all flesh came together into a single whole of flesh endowed with this aquiline quality. Then neither would there be, nor could there arise, any other thing that was aquiline. Similarly, suppose flesh and bones to be the matter of man, and suppose a man to be created of all flesh and all bones in indissoluble union. The possibility of another man would be removed. Whatever case you took it would be the same. The general rule is this: a thing whose essence resides in a substratum of matter can never come into being in the absence of all matter. †2[136] Now the universe is certainly a particular and a material thing: if however it is composed not of a part but of the whole of matter, then though the being of 'universe' and of 'this universe' are still distinct, yet there is no other universe, and no possibility of others being made, because all the matter is already included in this.

Lecture 19 (Aquinas' Commentary)

p 1-78

Lecture 19

Solution of the argument seeming to justify several worlds

p 1-78

184. After showing that there is but one world, the Philosopher here shows that it is impossible for there to be many. And it was necessary to prove this, because nothing prevents the possibility of something's being false [now] which can yet be true [later]. Concerning this he does three things:

First he presents an objection which seems to show that it is possible that many worlds exist;

Secondly, he answers it, at 194;

Thirdly, he proves something he had presupposed in his answer (L. 20).

p 1-78

About the first he does two things:

First he states his intention and his plan of treatment;

Secondly, he begins to prove his proposition, at 186.

p 1-78

185. He says therefore first [†127] that after the foregoing, we must still prove that not only is there one world but that it is impossible for there to be more, and further that the world is eternal, so as to be imperishable, i.e. never ceasing to be, and unborn, i.e., never beginning to be, according to his opinion. He states this because the first consideration seems somehow to depend on the second. For if the world were generable and perishable by union and separation, according to friendship and strife, as Empedocles said, many worlds would be possible in the sense that when one had perished another would be generated later, as Empedocles believed. And because the truth is truly known when the difficulties which seem to be contrary to it are solved, therefore the first thing to do is bring forth the difficulties concerning this, i.e., which seem to indicate that there are or can be many worlds — for the solution to this difficulty will confirm the truth.

p 1-78

186. Then at [†128] he presents the argument that could lead one to question whether it is not possible for more than one world to exist. Hence he prefaces the remark that, for those who hold this point of view, i.e., the one coinciding with the argument to follow, it will appear impossible that it, namely, the world, be one and unique, i.e., that there be necessarily just one world. For the following argument does not prove that it is necessary that there be several worlds, which is equivalent to its being impossible that there be but one; rather it proves that it is possible that there be more than one world, which is equivalent to its not being

necessary that there be but one. Now in order to show this he induces an argument containing two syllogisms:

The first of these is at 187;

The second at 190.

p 1-78

The first syllogism is this: In all sensible things that come to be by art or by nature, the consideration of the form considered in itself is one thing and the consideration of the form insofar as it is in matter is another. But the heaven is a sensible thing having a form in matter. Therefore, the absolute consideration of its form, i.e., as considered universally, is one thing, and the consideration of its form in matter, i.e., as considered in particular is another.

p 1-79

First, therefore, he presents the major, at 187;

Secondly, the minor, at 188;

Thirdly, he draws the conclusion, at 189.

p 1-79

187. He says therefore first [†128] that in all things that exist and were generated, i.e., made, either by nature or by art, the form considered according to itself is one thing according to our consideration, and the form mixed with matter, i.e., the form taken as joined with matter, is another.

p 1-79

He first explains this by an example in mathematical objects in which it is more evident, because sensible matter does not enter therein. For the species of a sphere is according to our consideration other than the form of the sphere in sensible matter, which is denoted when a sphere is called "golden" or "bronze"; similarly, the form of a circle is one thing, and what is meant by a golden or bronze circle is another. And this is evident, because when we give the *quod quid erat esse*, i.e., the defining notion, of a circle or a sphere, we make no mention therein of gold or bronze. This implies that to be "golden" or "bronze" does not pertain to their substance [essence], which the definition signifies.

p 1-79

But there seems to be a difficulty in natural things, whose forms cannot exist or be understood without sensible matter, as "snub" cannot exist and be understood without "nose." Natural forms, however, although they cannot be understood without sensible matter in common, can be understood without signed sensible matter, which is the principle of individuation and of singularity. Thus, "foot" cannot be understood without flesh and bones, but it can be understood without *this* flesh and *these* bones. And therefore he adds that if we cannot understand and accept in our consideration anything outside the singular, i.e., outside the matter which is included in the notion of the individual, namely, as it is signate — because sometimes there is nothing to prevent this from happening (namely, that a form be able to be understood without sensible matter) in the same way that we understood a circle without sensible matter; nevertheless, in natural things, in which forms are not understood without matter, the notions of the thing taken in common and taken in the singular are not the same, any more than the notion of "man" and of "this man" are the same. Thus the essence of "circle" and "this circle," i.e., of the notions defining a circle, and *this* circle, are different. For the notion of a thing in common is the species, i.e., the notion of the species, but the notion of a particular thing signifies the notion of the species as found in determinate matter, and pertains to the singular.

pertains to the singular.

188. Then at [†129] he presents the minor of his syllogism. And he says that since the heaven, i.e., the world, is something sensible, it must be among the singulars, for every sensible thing exists in matter. For a form not in matter is not sensible but intelligible only — for sensible qualities are characteristics of matter.

189. Then at [†130] he presents the conclusion and says that if the heaven, i.e., the world, belongs among the singulars, as has been shown, its notion as a singular will differ from its notion absolutely, i.e., taken universally the two notions will differ. Consequently, it follows that "this heaven" taken singularly will be different in consideration from "heaven" taken universally, i.e., this latter heaven taken universally will be as a species and form, while the other, namely, that taken singularly, will be as form joined to matter. However, this is not to be taken as implying that in the definition of a natural thing taken universally no matter is mentioned at all, but rather that individual matter is not mentioned.

190. Then at [†131] he presents the second syllogism, as follows: Whatever things have their forms in matter, are, or are able to be, several individuals of one species. But "this heaven" signifies a form in matter, as was said. Therefore, there either are, or can be, many heavens.

Now in regard to this he first presents the major;

Secondly, he explains it, at 191;

Thirdly, [having taken the minor from the previous syllogism], he draws the conclusion at 192.

He says therefore first [†131] that all things of which there is a form and species, i.e., which are not themselves forms and species, but *have* forms and species, are either many individuals of one species or many can exist. But things that are themselves forms and subsistent species, as are separated substances, cannot have several members of one species.

191. Then at [†132] he explains the foregoing both according to Plato's opinion and according to his own. And he says that whether there are "species," i.e., separated ideas, as the Platonists assume, then this must happen, i.e., there must be several individuals of one species — because the separated species is posited as the exemplar of a sensible thing and it is possible to make many copies according to one exemplar; or whether no such species exist separately, there can still be several individuals of one species. For we see this happen in all things whose substance (i.e., whose essence, which is signified by the definition) exists in signate matter, namely, that there are several individuals, or even an infinitude of individuals, of one species. The reason for this is that, since signate matter does not enter the notion of the species, the notion of the species can be indifferently verified in this individual matter and in that; consequently, there can be many individuals of one species.

192. Then at [†133] he draws the intended conclusion, namely, that either there are many worlds or many worlds can be made.

p 1-80

Finally he says in summary that from the foregoing someone can conjecture that either there are, or can be, many worlds.

p 1-80

193. But there seems to be a conflict here between Aristotle and Plato. For Plato in the *Timaeus* proved the oneness of the world from the oneness of the exemplar; but here Aristotle from the oneness of the separated species concludes to the possibility of several worlds.

p 1-80

But two answers can be given to this. First on the part of the exemplar, which, if it is one in such a way that oneness is its essence, then the copy must imitate the exemplar in this oneness. But the first separated exemplar is such. Hence also the world, which is the first copy thereof, must be one. This was the way Plato proceeded in his proof. But if oneness is not of the essence of the exemplar but is outside its essence, then the copy could be like the exemplar in respect to what belongs to its species — for example, in the notion of man or horse — but not in respect to oneness. And it is in this way that Aristotle's reasoning proceeds.

p 1-80

Or it can be answered from the viewpoint of the copy, which is more perfect to the extent that it is more faithful to the exemplar. Therefore, some copies are like one exemplar in respect to oneness of species, but not in respect to numerical oneness. But the heaven, which is a perfect copy, is like its exemplar with respect to numerical oneness.

p 1-81

194. Then at [†134] he solves this objection:

First he gives the solution;

Secondly, he explains it, at 195.

p 1-81

He says therefore first [†134] that in order to settle the above doubt we must once more consider what was said well and what not well. For if all the premises are true, the conclusion is necessarily true. He says, therefore, that it was correct to say that the notion of form differs, namely, in the case of that which is without matter and in the case of that which is with matter. This is to be granted as true. Consequently, the first conclusion which is the minor of the second syllogism is conceded. But from this it does not follow of necessity either that there are several worlds, or that there can be several, if it is true that this world consists of all its matter, as is true and as will be proved below. For the major proposition of the second syllogism, namely, that things which have a form in matter can be numerically many in one species, is not true except in things that do not consist of their entire matter.

p 1-81

195. Then at [†135] he explains what he had said with an example.

p 1-81

First he gives the examples;

Secondly, he adapts them to his proposition, at 196.

p 1-81

He says therefore first [†135] that what has been said will become clearer from what will be said. For snub-nosedness is curvature in a nose or in flesh; thus flesh is the matter of snub-nosedness. If then from all flesh one flesh were to be made, namely, the flesh of one nose, and snub-nosedness existed in it, nothing else would be snub-nosed nor could be. And the same holds for man, since flesh and bones are the matter of man: if one man were formed from all the flesh and all the bones, so that he could now not be destroyed, there could be no more than one man — but if he could be destroyed, it would be possible, after his corruption, for another man to exist, just as when a box is destroyed, another can be made from the same wood. And the same is true for other things. And the reason for this he assigns, namely, that none of the things whose form is in matter can come into being if the proper matter is not at hand, any more than a house could be made if there were not stones and wood. Consequently, if there were no bones and flesh other than those of which the one man is composed, no other man could come into being but him.

p 1-81

196. Then at [†136] he adapts this to his proposition. And he says it is true that the heaven is a singular thing and one constituted of matter. But it is not constituted out of part of its matter, but out of all of it. And therefore, although there is a difference between the notions of "heaven" and "this heaven," there neither is, nor can be, another heaven, due to the fact that all the matter of heaven is comprehended under this heaven.

p 1-81

197. However, it should be realized that some prove the possibility of many worlds in other ways. In one way, as follows: The world was made by God; but the power of God, since it is infinite, is not limited to this world alone. Therefore it is not reasonable to say that He cannot make yet other worlds.

p 1-81

To this it must be said that if God were to make other worlds, He would make them either like or unlike this world. If entirely alike, they would be in vain — and that conflicts with His wisdom. If unlike, none of them would comprehend in itself every nature of sensible body; consequently no one of them would be perfect, but one perfect world would result from all of them.

p 1-82

In another way, as follows: To the extent that something is more noble, to that extent is its species more powerful. But the world is nobler than any natural thing existing here. Therefore, since the species of a natural thing existing here, for example, of a horse or cow, could perfect many individuals, much more so can the species of the whole world perfect many individuals.

p 1-82

But to this it must be answered that it takes more power to make one perfect than to make several imperfect. Now the single individuals of natural things which exist here are imperfect, because no one of them comprehends within itself the total of what pertains to its species. But it is in this way that the world is perfect; hence, from that very fact its species is shown to be more powerful.

p 1-82

Thirdly, one objects thus: It is better for the best to be multiplied than for things not so good. But the world is the best. Therefore, it is better to have many worlds than many animals or many plants.

p 1-82

To this it must be said that here it pertains to the goodness of the world to be one, because oneness

possesses the aspect of goodness. For we see that through being divided some things lose their proper goodness.

Lecture 20 (Aristotle's Text)

[137] It remains, then, only to prove that it is composed of all natural perceptible body.

First, however, we must explain what we mean by 'heaven' and in how many senses we use the word, in order to make clearer the object of our inquiry. [138] *(a)* In one sense, then, we call 'heaven' the substance of the extreme circumference of the whole, or that natural body whose place is at the extreme circumference. We recognize habitually a special right to the name 'heaven' in the extremity or upper region, which we take to be the seat of all that is divine. †1 *(b)* In another sense, we use this name for the body continuous with the extreme circumference, which contains the moon, the sun, and some of the stars; these we say are 'in the heaven'. *(c)* In yet another sense we give the name to all body included within the extreme circumference, since we habitually call the whole or totality 'the heaven'. [139] The word, then, is used in three senses.

Now the whole included within the extreme circumference must be composed of *all* physical and sensible body, because there neither is, nor can come into being, any body outside the heaven. [140] For if there is a natural body outside the extreme circumference it must be either a simple or a composite body, and its position must be either natural or unnatural. [141] But it cannot be any of the simple bodies. For, first, it has been shown †2 that that which moves in a circle cannot change its place. And, secondly, it cannot be that which moves from the centre or that which lies lowest. *Naturally* they could not be there, since their proper places are elsewhere; [142] and if these are there *unnaturally,* the exterior place will be natural to some other body, since a place which is unnatural to one body must be natural to another: but we saw that there is no other body besides these. †3 Then it is not possible that any simple body should be outside the heaven. [143] But, if no simple body, neither can any mixed body be there: for the presence of the simple body is involved in the presence of the mixture. [144] Further neither can any body come into that place: for it will do so either naturally or unnaturally, and will be either simple or composite; so that the same argument will apply, since it makes no difference whether the question is 'does *A* exist?' or 'could *A* come to exist?' [145] From our arguments then it is evident not only that there is not, but also that there could never come to be, any bodily mass whatever outside the circumference. The world as a whole, therefore, includes *all* its appropriate matter, which is, as we saw, natural perceptible body. So that neither are there now, nor have there ever been, nor can there ever be formed more heavens than one, but this heaven of ours is one and unique and complete.

Lecture 20 (Aquinas' Commentary)

p 1-83

Lecture 20

The universe shown to consist of every natural and sensible body as its matter

p 1-83

198. Having presented the solution brought forward, the Philosopher here proves what he had presupposed, namely, that the world consists of all its matter.

p 1-83

First he tells his intention and order of procedure [†137] and says that in order to complete the preceding solution, we must show that the world consists of every natural and sensible body, which is its matter. But before showing this, it is necessary to explain what is meant by this word "heaven," and in how many senses it is used, so that our question can be answered more clearly.

p 1-83

199. Secondly he proves his proposition:

First he shows the various senses of the word "heaven";

Secondly, he proves the main proposition, at 200.

p 1-83

With regard to the first [†138] he gives three senses of heaven. In one way the heaven is called "the substance of the extreme circulation of the whole," i.e., that which is at the boundary of the whole universe and is moved circularly. And because he had explained the meaning of the word in terms of "substance," whose notion transcends natural philosophy, since it pertains to metaphysics, he adds another explanation having the same meaning, saying that the heaven is "the natural body whose place is at the extreme circumference of the world," which explanation is more befitting to natural science.

p 1-83

He proves this meaning from the way people speak — since words are to be used in the sense most people use them, as is said in *Topics* II. For men are more likely to call "heaven" that which is the extreme of the entire world and which is most up, not, indeed, as "up" is taken in natural science, i.e., as being the terminus of the motion of light things (for in this sense nothing is farther "up" than the place to which fire is borne) but as taken according to common parlance, where "up" designates that which is farther from the middle. "Up" also refers to the place of all divine beings (where "divine" signifies not celestial bodies — not all of which are in the outermost sphere — but non-material and incorporeal substances), for it has been said above that all men attribute to God a place that is up.

p 1-83

In a second way "heaven" means not only the outermost sphere but "the whole body continuous with the

extreme circumference of the whole universe," i.e., all the spheres of celestial bodies, in which exist the moon and sun and certain of the stars, namely, the other five planets (for the fixed stars are in the supreme sphere according to the opinion of Aristotle, who did not posit another sphere above that of the fixed stars).

p 1-83

And he proves this meaning also on the basis of common parlance: for we say that the sun and moon and other planets exist in the heaven. Now these bodies are said to be continuous with the extreme sphere, because they are alike in nature, i.e., they are imperishable and movable circularly, and not because one continuous body is formed from all of them — for then they could not have several and different motions, a continuum being something whose motion is one, as is said in *Metaphysics* V.

p 1-83

In a third way "heaven" means "the whole body contained within the extreme circumference," i.e., by the extreme sphere. This, too, he proves from the common use of the word — since we are wont to call the whole world and the totality, i.e., the universe, the "heaven."

p 1-84

It should be noted that "heaven" is here used in these three ways not equivocally but analogically, i.e., in relation to one first. For it is the supreme sphere that is first and principally called "heaven"; secondly, the other celestial spheres from the continuity they have with the supreme sphere; thirdly, the universe of bodies insofar as they are contained by the extreme sphere.

p 1-84

200. Then at [†139] he proves the proposition.

First he shows that there is no sensible body outside the heaven taken in the third sense, i.e., outside this world;

Secondly, he shows that there is not outside it any of the things that are normally consequent upon natural bodies (L. 21).

p 1-84

As to the first he does three things:

First he proposes what he intends;

Secondly, he proves his proposition, at 201;

Thirdly, he concludes to his main proposition, at 206.

p 1-84

He says therefore first [†139] that whereas "heaven" is said in three ways, we shall be discussing it now in its third sense, where heaven is taken as "the whole contained by the extreme circumference." Concerning this heaven it is necessary that it consist of every sensible and natural body — which is its matter, and thus it consists of all its matter — due to the fact that outside this heaven no body exists, nor can exist.

p 1-84

201. Then at [†140] he proves the proposition.

First he shows that there is no body outside the heaven;

Secondly, that none can be there, at 205.

p 1-84

About the first he does two things:

First he presents a division through which he manifests the proposition; Secondly, he excludes each member of the division, at 202.

p 1-84

He says therefore first [†140] that if there is a physical, i.e., natural, body outside the extreme periphery, i.e., circumference, it has to be either of the number of simple bodies, or of the number of composite bodies. Moreover, it must exist there according to nature, or outside its nature.

p 1-84

202. Then at [†141] he eliminates each member of this division. First he shows that outside the extreme sphere no simple body exists according to nature. For simple bodies are such that one is moved circularly, one from the middle, and one is moved to the middle and in the middle supports all the others, as was had above. But none of these bodies can exist outside the extreme circumference. For it has been shown above in *Physics* VI that the circularly moved body does not as to its whole being change its place except in conception. Consequently, it is not possible for that body which is moved circularly to be transferred to a place outside of that in which it exists. But this would follow, if there were a circularly moved body existing outside the extreme circumference as in its natural place. Since the reason that it would be natural to that circularly moved body would also make it natural to the body circularly moved in this world, and every body is naturally borne to its natural place, it would follow, therefore, that that latter circularly moved body would be transferred outside its proper place to another place — which is impossible.

p 1-85

Similarly it is not possible for a light body which is moved from the center to be outside the extreme circumference or for a heavy body which supports the other bodies in the center. For if it is maintained that they exist naturally outside the extreme circumference, such a thing cannot be, since they have other natural places, namely, within the extreme circumference of the whole. For it was shown above that there is one numerical place for all heavy bodies and one for all light bodies. Hence it is not possible that those bodies be naturally outside the extreme circumference of the whole.

p 1-85

And it should be noted that this argument, both as to the body circularly moved, and as to the body moved with straight motion, possesses necessity on account of what was proved above, namely, that there is but one extreme and one middle.

p 1-85

203. Secondly, at [†142] he shows that no simple body is outside the heaven outside its nature. For if it were there in that manner that place would be natural to some other body; for a place outside nature for one body must be according to nature for some other — if a proper body were lacking to a place, that place would exist in vain. But it cannot be said that that place is natural to any body: for it is not natural to a circularly moved body, nor to a light or heavy body. But it has been shown above that there are no other bodies besides these. Consequently, it is plain that no simple body exists outside the heaven, either according to nature or outside nature.

p 1-85

204. Thirdly, at [†143] he proves that there is no mixed body there. For if none of the simple bodies exists there, it follows that no mixed body is. Wherever there is a mixed body, simple bodies must be there, due to the fact that simple bodies are present in the mixed; and a mixed body gets its natural place according to the simple body predominant in it.

205. Then at [†144] he shows that outside the heaven there cannot be any body. Hence he says that it is not possible for a body to come to be outside the heaven. For it would be there either according to nature or outside nature; again, it would be either simple or mixed. But no matter which of these is given, the same situation as above would prevail. For according to the above-stated reasons, it makes no difference whether the question concerns the existence of a body outside the heaven, or the possibility of its coming to be there, since the foregoing arguments conclude both, and since in sempiternal things to be and to be able to be do not differ, as is said in *Physics* III.

206. Then at [†145] he draws the conclusion mainly intended. And he says it is manifest from what has been said that outside the heaven no mass of any sort of body exists, nor can exist, since the whole world consists of its entire proper matter and the matter of the world is the sensible natural body.

However, it should be not understood that he wishes to prove that no sensible body exists outside the heaven on the ground that it consists of the totality of its matter; but rather the converse. Nevertheless, he uses that manner of speaking because the two are mutually convertible.

He concludes, therefore, that there are not many worlds at present, nor were there many in the past, nor will there ever be able to be in the future. Rather the heaven is one and unique and perfect in the sense of consisting of all its parts or of its total matter.

Lecture 21 (Aristotle's Text)

279a12-279b3

[146] It is therefore evident that there is also no place or void or time outside the heaven. [147] For in every place body can be present; [148] and void is said to be that in which the presence of body, though not actual, is possible; [149] and time is the number of movement. But in the absence of natural body there is no movement, and outside the heaven, as we have shown, body neither exists nor can come to exist. [150] It is clear then that there is neither place, nor void, nor time, outside the heaven. [151] Hence whatever is there, is of such a nature as not to occupy any place, nor does time age it; nor is there any change in any of the things which lie beyond the outermost motion; [152] they continue through their entire duration unalterable and unmodified, living the best and most self-sufficient of lives. [153] As a matter of fact, this word 'duration' possessed a divine significance for the ancients, for the fulfilment which includes the period of life of any creature, outside of which no natural development can fall, has been called its duration. On the same principle the fulfilment of the whole heaven, the fulfilment which includes all time and infinity, is 'duration'—a name based upon the fact that it *is always* †1-duration immortal and divine. [154] From it derive the being and life which other things, some more or less articulately but others feebly, enjoy. [155] So, too, in its discussions concerning the divine, popular philosophy †2 often propounds the view that whatever is divine, whatever is primary and supreme, is necessarily unchangeable. This fact confirms what we have said. [156] For there is nothing else stronger than it to move it—since that would mean more divine—[157] and it has no defect and lacks none of its proper excellences. [158] Its unceasing movement, then, is also reasonable, since everything ceases to move when it comes to its proper place, but the body whose path is the circle has one and the same place for starting-point and goal.

Lecture 21 (Aquinas' Commentary)

p 1-86
Lecture 21

Outside the heaven no things consequent upon sensible bodies. Which things are?
p 1-86
207. After showing that there neither is, nor can be, any sensible body outside the heaven, the Philosopher here shows that outside the heaven there is none of the things that follow upon sensible bodies.

p 1-86
First he proves the proposition;

Secondly, he describes the things that do exist outside the heaven, at 213.

p 1-86

About the first he does three things:

First he proposes what he intends;

Secondly, he proves the proposition, at 208;

Thirdly, he draws the intended conclusion, at 212.

p 1-86

He says therefore first [†146] that with the proof that outside the heaven there is no sensible body, it is also manifest that outside the heaven there is neither place nor void nor time — for these three things were discussed as being concomitants of natural bodies in *Physics* IV.

p 1-86

208. Then at [†147] he proves the proposition.

First, as to place: In every place it is possible for a body to exist, otherwise it would be in vain. But outside the heaven it is not possible for any body to exist, as was proved. Therefore, outside the heaven there is no place.

p 1-86

Secondly, at [†148] he proves that outside the heaven there is not a void: Those who posit a void define it to be a place in which a body is not existing but can exist. But outside the heaven it is not possible for a body to exist, as has been shown. Therefore, outside the heaven there is not a void.

p 1-86

209. But it should be noted that the Stoics posited an infinite void, in one part of which the world exists. Consequently, according to them, there is a void outside the heaven. They wanted to prove this with the following fantasy: If someone were on the extreme circumference of the heaven, he could either extend his hand beyond or not. If not, then it is being impeded by something existing beyond. The same question will return regarding that thing existing beyond, if anyone could, while on the extremity, reach out his hand beyond. Consequently we must go on infinitely, or come to an extreme body beyond which a man existing there could reach out his hand. In that case it follows that beyond that a body could exist and does not. Hence there will be a void beyond.

p 1-86

To this Alexander responds that the position is impossible. For since the body of the heaven cannot undergo anything, it cannot receive anything extraneous. Hence, if from this impossible assumption, something against the thesis follows, one should pay it no heed.

p 1-86

But this answer does not seem to be sufficient — since the impossibility of this position is not on the part of something outside the heaven but on the part of the heaven itself. But now we are dealing with what is outside the heaven. Hence it is the same argument if the whole universe were the earth, on whose boundary a man could exist. Consequently, we must state otherwise, just as he says, that a man situated on the extreme circumference could not extend his hand beyond, not because of something outside impeding it, but because it is of the very nature of all natural bodies that they be contained within the extreme circumference of the heaven — otherwise the heaven would not be the universe. Hence if there were a

body not depending on the body of the heaven as on a container, there would be nothing to prevent it from existing outside the heaven, as in the case of the spiritual substances, as will be said below.

p 1-87

210. But that there is no void outside the heaven Alexander proves on the ground that such a void is either finite or infinite: If finite, then it is terminated somewhere and the same question will return: Could a person extend his hand beyond that? If it is infinite, it will be capable of receiving an infinite body: then either that power of the void will be in vain or it will be necessary to posit an infinite body capable of being received into the void of the infinite.

p 1-87

Likewise, if there is a void outside the world, the world will be related to each part of the void in exactly the same way, because in a void there are no differences. Consequently, this part of the void in which the world exists is not its proper place. Therefore there is no cause why it should remain in this part of the void. But if the world is in motion, it will not be moved to one part rather than to another, because in the void there are no differences. Therefore, it will be moved in every direction; and thus the world will be torn asunder.

p 1-87

211. Thirdly, at [†149] he proves that outside the heaven there is no time. For time is the number of motion, as is plain in *Physics* IV. But motion cannot exist without a natural body, and a natural body neither exists nor can exist outside the heaven, as has been proved. Therefore, outside the heaven there neither is, nor can be, time.

p 1-87

212. Then at [†150] he draws the conclusion intended, and concludes that it is manifest from the foregoing that outside the whole heaven there is neither place nor void nor time.

p 1-87

213. Then at [†151] he describes what type of things are outside the heaven. About this he does two things:

First he concludes their condition from the foregoing;

Secondly, he shows the same from common opinion, at 217.

p 1-87

About the first he does two things:

First he removes from them the condition of things that exist here;

Secondly, he describes their proper condition, at 214.

p 1-87

He says therefore first [†151] that because there is no place outside the heaven, it follows that things by nature apt to be there do not exist in place. And Alexander says that this can be understood about the heaven itself, which is not in place as a whole but with respect to its parts, as is proved in *Physics* IV.

p 1-87

Again, because time does not exist beyond the heaven, it follows that they do not exist in time;

consequently, time does not make them grow old. And this, too, according to Alexander, can belong to the heaven, which, indeed, is not in time in the sense that to be in time consists in being measured by some part of time, as is said in *Physics* IV. Not only do such beings not grow old in time, but no change affects those things which lie "beyond the outermost motion [lationem]," i.e., beyond the local motion of light bodies — for he is accustomed to call rectilinear motion *latio*.

p 1-88

But it does not seem to be true that no change affects heavenly bodies, since they are moved locally, unless perhaps we limit "change" to one affecting the substance. But this seems to be a forced explanation, since the Philosopher excludes all change universally. Likewise, it cannot be properly said that the heaven is there, i.e., outside the heaven. Consequently, it is better to understand his words as applying to God and separated substances which plainly are not contained by time, nor place, since they are separated from all magnitude and motion. Such substances are said to be "there," i.e., outside the heaven, not as in a place, but as not contained nor included under the containment of bodily things, and as exceeding all of corporeal nature. It is such beings that the expression befits, namely, that they undergo no change; because they lie beyond the extreme motion, namely, that of the farthest sphere, which is ordered as extrinsic to and containing all change.

p 1-88

214. Then at [†152] he explains the qualities of these beings.

First he describes their condition;

Secondly, he explains a word he used, at 215;

Thirdly, he shows the influence of these beings on others, at 216.

p 1-88

He says therefore first [†152] that those beings which are outside the heaven are unalterable and wholly impassible. They lead the best of lives, inasmuch as their life is not mingled with matter as is the life of corporeal beings. They also have a life that is most self-sufficient, inasmuch as they do not need anything in order to conserve their life or to perform the works of life. They have a life, too, which is not temporal but in total eternity.

p 1-88

Now, among the qualities here listed some can be attributed to heavenly bodies — for example, that they are impassible and unalterable. But the other two cannot belong to them, even if they are alive. For they do not have the best life, since their life would be one resulting from the union of a soul to a celestial body; neither do they have a most self-sufficient life, since they attain their good through motion, as will be said in Book II.

p 1-88

215. Then at [†153] he explains the word "eternal" which he had used. And he says that the ancients pronounced this word as divine, i.e., as befitting divine things. Now this word has two meanings.

p 1-88

In one way it is used in a qualified sense as meaning the eternity or age [saeculum] of a thing: for in Greek the same word signifies both. He says, therefore, that the eternity or age of a thing is called an end, i.e., a certain terminal measure which contains the time of any thing's life, in such a way that no time of the life belonging to the thing according to nature exists outside that end or measure. It is like saying that the span

of 100 years is the "age" or "eternity" of a man.

p 1-88

In another way "eternity" is used in an absolute sense as comprehending and containing all duration. And this is what he says, namely, that according to the same notion, eternity is called the end of the entire heaven, i.e., it is the span containing the entire duration of the heaven, i.e., the span of all of time. In this sense, eternity refers to a certain perfection which contains all time and the entire infinitude of duration — not as though this eternity is stretched out according to the succession of past and future, as in the case of any span of time, because such succession follows upon motion, whereas the things he described as having life in eternity are completely immobile, but this eternity is a whole existing all at once and comprehending all time and all infinitude. (The Greek word [in English "aeon"] is derived from the words for "always existing".) Such an end, which is called "eternal" is immortal, because that life is not ended by death, and "divine," because it is beyond all matter, quantity, and motion.

p 1-89

216. Then at [†154] he shows the influence of these things on others. Now it is manifest that from what is most perfect there is a flowing to others that are less perfect, just as heat flows from fire to other things that are less hot, as is said in *Metaphysics* II. Hence, since those beings possess the best and most self-sufficient life and eternal existence, it is from them that existence and life are communicated to other things. But not equally to all; rather, to some "more luminously," i.e., more evidently and more perfectly, namely, to those that have individual eternal existence and to those that have rational life; to others "more darkly," i.e., in a lesser and more imperfect way, namely, to those things that are eternal, not in the same individuals, but according to sameness of species, and which have sense or nutritive life.

p 1-89

217. Then at [†155] he manifests what he had said about the condition of the aforesaid beings that exist outside the heaven.

p 1-89

First he proposes what he intends;

Secondly, he presents reasons, at 218.

p 1-89

With respect to the first [†155] it should be known that among the philosophers there were two kinds of teachings. For there were some which from the very beginning were proposed according to the order of doctrine to the multitude and these were called "encyclia"; others were more subtle, and were proposed to the more advanced hearers and were called "syntagmatica," i.e., co-ordinal, or "acromatica," i.e., hearable, teachings. The dogmas of the philosophers are called "philosophemata."

p 1-89

He says, therefore, that in the "encyclic" [or popular] philosophic discussions concerning divine things the philosophers very often in their arguments showed that everything divine must be "untransmutable," as not subject to motion, and "first," as not subject to time, and "highest," as not contained by place. And they called every separated substance "divine." And this confirms what has been said about such beings.

p 1-89

218. Then at [†156] he gives reasons to manifest what he had said, namely, that the first and highest is untransmutable.

p 1-89

First he manifests the proposition;

Secondly, he draws a conclusion, at 220.

p 1-89

In regard to the first he gives two arguments, the first of which is as follows: What is always causing motion and acting is better than what is moved and acted upon. But there is nothing better than the first and highest divinity, so as to be able to move it, because such a mover would be more divine. Therefore, the first divine being is not moved, since whatever is moved must be moved by another, as is proved in *Physics* VII and VIII.

p 1-89

219. The second argument is at [†157]: Whatever is moved is moved either to avoid an evil or acquire a good. But what is first has no evil to avoid and lacks no good that it could acquire, because it is most perfect. Therefore, the first is not moved.

p 1-89

The argument could also be presented in the following way: Whatever is moved is moved either to better or to worse. But neither of these can belong to God according to what is said here. Therefore, God, is in no way moved. And one should note that this second argument may be introduced to show that He is not moved by Himself.

p 1-90

220. Then at [†158] from the foregoing he draws a conclusion. And he says it "reasonably," i.e., probably, follows that that first mover of the first mobile acts with unceasable motion. For whatever things, after having been moved, rest, these do so when they reach their appropriate place, as is clear in heavy and light bodies. But this cannot be said of the first mobile which is moved circularly, because where its motion starts is the same as where it ends. Therefore, the first mobile is moved by the first mover with an unceasing motion.

p 1-90

And it should be noted that this argument does not conclude of necessity. For it can be said that the motion of the heaven does not cease, not on account of the nature of the place, but on account of the will of the mover. Therefore, he does not present this as a necessary, but as a probable, conclusion.

Lecture 22 (Aristotle's Text)

279b4-279b13

[159] Having established these distinctions, we may now proceed to the question whether the heaven is ungenerated or generated, indestructible or destructible. Let us start with a review of the theories of other thinkers; [160] for the proofs of a theory are difficulties for the contrary theory. †1[161] Besides, those who have first heard the pleas of our adversaries will be more likely to credit the assertions which we are going to make. [162] We shall be less open to the charge of procuring judgement by default. To give a satisfactory decision as to the truth it is necessary to be rather an arbitrator than a party to the dispute.

279b14-279b16

[163] That the world was generated all are agreed, [164] but, generation over, some say that it is eternal, others say that it is destructible like any other natural formation. †2 Others again, with Empedocles of Acragas and Heraclitus of Ephesus, believe that there is alternation in the destructive process, which takes now this direction, now that, and continues without end. †3

279b17-279b32

[165] Now to assert that it was generated and yet is eternal is to assert the impossible; for we cannot reasonably attribute to anything any characteristics but those which observation detects in many or all instances. But in this case the facts point the other way: generated things are seen always to be destroyed. [166] Further, a thing whose present state had no beginning and which could not have been other than it was at any previous moment throughout its entire duration, cannot possibly be changed. †1 For there will have to be some cause of change, and if this had been present earlier it would have made possible another condition of that to which any other condition was impossible. Suppose that the world was formed out of elements which were formerly otherwise conditioned than as they are now. Then (1) if their condition was always so and could not have been otherwise, the world could never have come into being. †2 And (2) if the world did come into being, then, clearly, their condition must have been capable of change and not eternal: after combination therefore they will be dispersed, just as in the past after dispersion they came into combination, and this process either has been, or could have been, indefinitely repeated. But if this is so, the world cannot be indestructible, and it does not matter whether the change of condition has actually occurred or remains a possibility.

Lecture 22 (Aquinas' Commentary)

p 1-91

Lecture 22

Opinions on whether the universe is generated or not, corruptible or not.

221. After showing that the body of the whole world is not infinite and that it is not more than one in number, the Philosopher here inquires whether it is infinite with an eternity of duration.

First he presents the opinions of others;

Secondly, he determines the proposition according to his opinion (L. 24).

About the first he does three things:

First he tells what he intends;

Secondly, he presents the opinions, at 226;

Thirdly, he disproves them, at 229.

222. With regard to the first he does two things:

First he tells his intention and the way he plans to treat it at [†159]. And he says that after having determined the foregoing, we must now discuss whether the world is ungenerated or generated, i.e., whether it began through generation to exist at a definite beginning of time or not; and whether it is destructible or indestructible, i.e., whether or not through a process of perishing it will cease to be after a certain time. But before treating of these matters "according to our own opinion" we ought briefly touch upon the suspicions, i.e., opinions, of other philosophers about this. He calls them "suspicions" because they were moved to say what they said through slight reasons. For it is difficult to give strong arguments on these problems. Hence Aristotle himself says in *Topics* I that there are certain problems concerning which we do not have arguments, such as whether the world is eternal or not.

223. Secondly, he gives three reasons why here and in other places he discusses the opinions of others. The first is that the demonstrations, i.e., proofs, of contraries, i.e., of contrary opinions, are objections to contraries, i.e., contrary opinions. But one who desires to know a truth should know the doubts which prevail against that truth, because the solution of doubts is the discovery of truth, as is said in *Metaphysics* III. Consequently it is very helpful in learning the truth to see the arguments of contrary opinions.

224. The second reason is given at [†161]. And he says that hand in hand with the foregoing reason is another, namely, that the things to be said are rendered more credible for those who first hear the justifications, i.e., the rectifications, of the statements of difficulties, i.e., the solutions of those arguments from which the doubt arose — for so long as a man is in a state of doubt, his mind is like a person who is bound and unable to move.

225. The third reason is at [†162], where he says that when we have presented the opinions of others and given their arguments, and solved them, and presented reasons to the contrary, we shall be less open to the accusation of condemning the statements of others "gratis," i.e., without sufficient reason — as in the case of those who reject the statements of others solely out of hatred. This is not becoming to philosophers,

who profess to be searchers of the truth. For those who wish to be adequate judges of the truth must not show themselves enemies of those whose statements are to be judged, but as arbiters, and inquirers for both sides.

p 1-92

226. Then at [†163] he gives the opinions of others. First he shows in what they all agree, and says that all who were before him stated that the world is generated, i.e., at a certain beginning of time it began to exist through generation.

p 1-92

227. Secondly, he shows in what they differ. And he touches on three opinions. First of all, some said that, although it began to be at a certain beginning of time, yet it will endure forever, as first was said by certain poets, such as Orpheus and Hesiod, who are called "theologians" because they presented divine things under the form of poetry and myths. Plato followed them in this position, holding the world to be generated but indestructible.

p 1-92

The second opinion was that of certain others, that the world is destructible in the same way as any other generated thing composed of many parts, and that after being destroyed, it will never be repaired, just as Socrates, once corrupted, is never restored by nature. And this was the opinion of Democritus, who declared the world to be generated by a fortuitous gathering together of atoms ever mobile, and likewise to be destined to be dissolved at some time by the separation of these atoms.

p 1-92

The third opinion is that of those who say the world is alternately generated and destroyed, and that this alternation has always endured and will always last. Such was the opinion of Empedocles of Agrigenta, for he posited that with friendship assembling the elements and strife separating them, the world was [continuously] generated and destroyed. This, too, was the opinion of Heraclitus of Ephesus, who posited that at some time the world would be consumed by fire and after a certain lapse of time would again be generated by fire, which he supposed was the principle of all things.

p 1-92

228. Now, some claim that these poets and philosophers, and especially Plato, did not understand these matters in the way their words sound on the surface, but wished to conceal their wisdom under certain fables and enigmatic statements. Moreover, they claim that Aristotle's custom in many cases was not to object against their understanding, which was sound, but against their words, lest anyone should fall into error on account of their way of speaking. So says Simplicius in his *Commentary*. But Alexander held that Plato and the other early philosophers understood the matter just as the words sound literally, and that Aristotle undertook to argue not only against their words but against their understanding as well. Whichever of these may be the case, it is of little concern to us, because the study of philosophy aims not at knowing what men feel, but at what is the truth of things.

p 1-92

229. Then at [†165] he refutes these opinions:

First, the first one;

Secondly, the third one, at 234;

Thirdly, the second one, at 235 (for the second has less of an argument).

p 1-92

About the first he does two things:

First he refutes the opinion;

Secondly, he rejects an excusing of it, at 231.

p 1-93

With respect to the first he presents two arguments, in the first of which he says that it is impossible for the world to have been made or generated from a certain beginning of time and then afterwards to endure forever. For when we want to assume something "reasonably," i.e., probably, without a demonstration, we must posit what we observe to be true in all or in many cases, for this is the very nature of the probable. But in this case the contrary happens, because all things that are generated we see to corrupt. Therefore one should not lay down that the world is generated and indestructible.

p 1-93

230. He gives the second argument at [†166]. And first he states a principle and says that if a thing is such that it does not have within itself a potency which is a principle of its being thus and otherwise, but it is impossible for it to have been otherwise throughout all preceding ages, then such a thing cannot be transmuted. This he proves by leading to an impossibility. For if such a thing should be transmuted, it would be when it is transmuted by some cause producing its transmutation, i.e., by its potency to transmutation. This potency, if it had existed before, would have made it possible for that thing to be other than it was, which thing, however, was assumed to be incapable of being otherwise. But if it previously lacked this potency to be otherwise, and later has it, that itself would be a transmutation of that thing. Consequently, even before it had the potency to be changed, it was able to be changed, namely, by receiving the power to be changed.

p 1-93

From this he argues thus to his proposition: If the world was made from certain things which, before the world was made, were otherwise constituted, then if it is true that those things from which the world was formed were never otherwise than they always were, and could never be otherwise, the world could not have been formed from them. But if the world was formed from them, then, necessarily, those things from which it was formed could be otherwise and do not remain always the same. Hence it follows that even as constituents, i.e., after being united to form the world, they can be separated again: and, when dispersed, they have been previously united, and they alternated thus infinitely, or could have. And if this is true, it follows that the world is not imperishable, nor ever will be imperishable, if the things of which the world consists were at one time otherwise, or even could have been: for in either case it follows that even now it is possible that they be otherwise.

Lecture 23 (Aristotle's Text)

279b33-280a11

[167] Some of those who hold that the world, though indestructible, was yet generated, try to support their case by a parallel which is illusory. †3 They say that in their statements about its generation they are doing what geometricians do when they construct their figures, not implying that the universe really had a beginning, but for didactic reasons facilitating understanding by exhibiting the object, like the figure, as in course of formation. [168] The two cases, as we said, are not parallel; for, in the construction of the figure, when the various steps are completed the required figure forthwith results; but in these other demonstrations what results is not that which was required. †1 Indeed it cannot be so; for antecedent and consequent, as assumed, are in contradiction. The ordered, it is said, †2 arose out of the unordered; and the same thing cannot be at the same time both ordered and unordered; there must be a process and a lapse of time separating the two states. In the figure, on the other hand, there is no temporal separation. †3 It is clear then that the universe cannot be at once eternal and generated.

280a12-280a23

[169] To say that the universe alternately combines and dissolves is no more paradoxical than to make it eternal but varying in shape. It is as if one were to think that there was now destruction and now existence when from a child a man is generated, and from a man a child. For it is clear that when the elements come together the result is not a chance system and combination, but the very same as before—especially on the view of those who hold this theory, since they say that the contrary is the cause of each state. †4 So that if the totality of body, which is a continuum, is now in this order or disposition and now in that, and if the combination of the whole is a world or heaven, then it will not be the world that comes into being and is destroyed, but only its dispositions.

280a24-280a33

[170] If the world is believed to be one, it is impossible to suppose that it should be, as a whole, first generated and then destroyed, never to reappear; since before it came into being there was always present the combination prior to it, and that, we hold, could never change if it was never generated. If, on the other hand, the worlds are infinite in number the view is more plausible. [171] But whether this is, or is not, impossible will be clear from what follows. For there are some who think it possible both for the ungenerated to be destroyed and for the generated to persist undestroyed. †1 (This is held in the *Timaeus*, †2 where Plato says that the heaven, though it was generated, will none the less exist to eternity.) So far as the heaven is concerned we have answered this view with arguments appropriate to the nature of the heaven: on the general question we shall attain clearness when we examine the matter universally. †3

Lecture 23 (Aquinas' Commentary)

Lecture 23

A Platonic evasion rejected. Two remaining opinions disproved.

231. After presenting the arguments against Plato, the Philosopher here rejects a certain excusing of the aforesaid opinion, which Xenocrates and other Platonists proposed. About this he does two things:

First he proposes the explanation;

Secondly, he rejects it, at 232.

He says, therefore, first [†167] that there is no truth in that "help," i.e., that excusing, by which some Platonists seek to justify their assertion — that the world is imperishable, but yet made or generated — and make it appear not unreasonable. For they say that their description of the world's generation was after the manner of those who describe geometric figures by first drawing certain parts of the figure, e.g., of a triangle, and later other parts, not implying that these parts existed before the figure was formed of them, but doing this in order to demonstrate more explicitly what things are required for the figure. They say that Plato in like manner declared that the world was made from elements, not as though the world was generated at some definite time, but for the purpose of presenting his doctrine, so that, namely, his hearers would be more easily instructed about the nature of the world, if first the parts of the world were demonstrated to them and what these parts possessed of themselves, and later the composition they had from the cause of the world, which is God. Consequently they look on, i.e., consider, the world as generated in the manner of the description which geometers use in describing figures.

232. Then at [†168] he disproves this explanation. And he says that the way the generation of the world is described by them is not in the same manner as the descriptions of figures made by geometers, as will be clear from what we shall now say. For in geometric descriptions the same thing happens whether all the parts are considered together as constituting the figure, or whether they are not taken together. When they are taken separately, no more is said about them than that they are lines or angles, which is also true of them when they are taken all together in the figure made out of them. But in the demonstrations presented by those who posit the generation of the world, the same thing is not taken when the parts are considered together and when they are not. Rather, it is impossible that the same be taken in both instances, just as it is impossible for opposites to be together — for the things taken first, i.e., before the establishing of the world, and those taken later, i.e., after the world is now established, are "subcontraries," i.e., have a certain conjoined and latent contrariety.

For they say that out of unordered elements, ordered things were made, God reducing the disorder among the elements to order, as Plato says in the *Timaeus*. But geometers do not say that a triangle is composed out of separated lines but out of lines. The situation would be similar if those in question solely said that the world results from elements, but what they say is that the orderly world came about from disordered elements. Now it is not possible for something to be at once ordered and disordered, but a process of generation is required through which one is separated from the other, so that before generation it is disordered, and after generation ordered. Consequently it is necessary to suppose some time distinguishing the two. But no such distinction of time is required in the descriptions of figures — for it is not necessary that a line and a triangle be distinguished in the order of time as ordered and disordered are.

233. Still others desire to excuse Plato on the ground that he did not teach that there was a prior disorder in the elements which subsequently, at a later time, began to be ordered, but rather disorder is always present under some aspect in the elements of the world, although under another aspect there is order, as Aristotle himself posits that matter always has a concomitant privation, although it is always in some respect under form. It is also possible to interpret Plato as stressing what the elements would be of themselves if they had not been put in order by God, not that there was ever a time in which they existed disordered.

But whatever Plato may have understood about the matter, Aristotle, as has been said, objected against what Plato's words express. He concludes, therefore, from the foregoing that it is impossible for the world to have been generated and yet able to go on forever.

234. Then at [†169] he takes up the opinion of Empedocles which is the third one mentioned. And he says that those who maintain that the world alternates between being assembled and dissolved do nothing more than assert the substantial permanence of the world but its transmutability with respect to its form or its arrangement. It is as though someone seeing a boy becoming a man, if it should be posited that he sees the same person becoming from a man a boy again, should reckon this person as [alternately] at one time coming into existence and at one time ceasing to be. That the opinion of Empedocles is tantamount to positing the substance of the world as eternal, he manifests by the fact that after the elements shall have been separated by strife and later reassembled, it is not just any order and any new arrangement that will ensue but the very same one that now exists.

And this is made clear "in another way," i.e., by reason, because the very same cause, namely, friendship, will assemble the elements which previously assembled them; consequently, the same arrangement of the world will result. And this is plain also from the teachings of those who hold this position and assert that friendship and strife are contrary and the causes of a contrary disposition in the elements, so that at one time they are assembled and at another separated. Hence he concludes that if the entire body of the world, while remaining "continuous," i.e., conjoined, is now disposed and arranged in one way and later in another way, then, since it is the "combination," or substance, of all bodies that is called the world or heaven, it follows that the world is not generated and destroyed but only its arrangements are.

235. Then at [†170] he takes Democritus' opinion, which was the second one mentioned.

First he explains this opinion;

Secondly, he shows what will later be clear about it, at 236.

He says therefore first [†170] that if someone should maintain that the world was made, and entirely ceases to be without returning, in such a way, namely, that it will never be restored again, such a thing is impossible, if there is but one world. The reason is that if there is but one world, made at some time, then, since it was not made from nothing, there was, previous to its being made, a substance which existed before it. Either we hold that that substance which pre-existed before the world could have been subject to generation, or that it could not. If not, then the world could not have been made from it. And this is what he says, namely, that if it was not made, or not generated, i.e., not subject to generation, we say it to be impossible of transmutation, i.e., not able to be transmuted in order for the world to be made out of it. But if it possessed in its nature the power to be transmuted, so that the world could be made from it, then also

if it possessed in its nature the power to be transmuted, so that the world could be made from it, then also after the destruction of the world it could be transmuted and a world made again from it.

p 1-96

But if someone posits infinite worlds, in the sense that from atoms arranged in one way this world comes to be, and from the same or other atoms differently arranged another world comes to be, and so on *ad infinitum,* such a position would be a better foundation for what was said, namely, that the world once destroyed is never again regenerated, because from the assumption that other worlds are possible, another world could be arranged from those atoms. However, if there could be but one world, something incompatible with the theory follows: the matter into which the world dissolved would still be in potency to have a world made from it. Hence if a different world were impossible, the very same one would have to be produced again.

p 1-96

236. Then at [†171] he shows what remains to be said, and says that from what will follow, it will be clear whether this is possible or impossible. And if "this" refers to what was just said of the opinion about infinite worlds, the phrase "what will follow" refers, not to what follows immediately, in which nothing is said about this opinion, but to what will be said about the opinion of Democritus in *On the Heavens* III and in *On Generation* I. But if "this" refers to the whole preceding section, where there is treated the opinion of those who posit that the world was generated, then the phrase "what will follow" refers to what immediately follows.

p 1-96

And this is confirmed by what he at once adds. For there are some who conceive it possible for something which was never generated to perish at some time, and for something newly generated to remain incorruptible, as Plato says in the *Timaeus* that the heaven was produced in being, but will nevertheless endure for eternity. Thus he posits both statements: that disarranged matter, which never became disarranged, at some time ceases to be, and that the world began, and never ceases to be. Against those who thus posit that the world began through generation, Aristotle argued above near the beginning of this book with natural reasons solely to the effect that the heaven was proved ungenerated and indestructible, on the ground that it has no contrary. But now this will be shown by a universal consideration of all beings.

Lecture 24 (Aristotle's Text)

280b1-280b6

[172] We must first distinguish the senses in which we use the words 'ungenerated' and 'generated', 'destructible' and 'indestructible'. †4[173] These have many meanings, and though it may make no difference to the argument, yet some confusion of mind must result from treating as uniform in its use a word which has several distinct applications. The character which is the ground of the predication will always remain obscure.

280b7-281a1

[174] The word 'ungenerated' then is used *(a)* in one sense whenever something now is which formerly was not, no process of becoming or change being involved. Such is the case, according to some, with contact and motion, since there is no process of coming to be in contact or in motion. *(b)* It is used in another sense, when something which is capable of coming to be, with or without process, does not exist; such a thing is ungenerated in the sense that its generation is not a fact but a possibility. *(c)* It is also applied where there is general impossibility of any generation such that the thing now is which then was not. And 'impossibility' has two uses: first, where it is untrue to say that the thing can ever come into being, and secondly, where it cannot do so easily, quickly, or well. [175] In the same way the word 'generated' is used, *(a)* first, where what formerly was not afterwards is, whether a process of becoming was or was not involved, so long as that which then was not, now is; *(b)* secondly, of anything capable of existing, 'capable' being defined with reference either to truth or to facility; *(c)* thirdly, of anything to which the passage from not being to being belongs, †1 whether already actual, if its existence is due to a past process of becoming, or not yet actual but only possible. [176] The uses of the words 'destructible' and 'indestructible' are similar. 'Destructible' is applied *(a)* to that which formerly was and afterwards either is not or might not be, whether a period of being destroyed and changed intervenes or not; †2 and *(b)* sometimes we apply the word to that which a process of destruction may cause not to be; and also *(c)* in a third sense, to that which is easily destructible, to the 'easily-destroyed', so to speak. †1[177] Of the indestructible the same account holds good. It is either *(a)* that which now is and now is not, without any process of destruction, like contact, which without being destroyed afterwards is not, though formerly it was; or *(b)* that which is but might not be, or which will at some time not be, though it now is. †2 For you exist now and so does the contact; yet both are destructible, because a time will come when it will not be true of you that you exist, nor of these things that they are in contact. Thirdly *(c)* in its most proper use, it is that which is, but is incapable of any destruction such that the thing which now is later ceases to be or might cease to be; or again, that which has not yet been destroyed, but in the future may cease to be. †3 For indestructible is also used of that which is destroyed with difficulty. †4

Lecture 24 (Aquinas' Commentary)

n 1-97

Lecture 24

Various meanings of "generable" and "ungenerable," "corruptible" and "incorruptible"
p 1-97

237. After discussing others' opinions about whether the world is generated and destructible [corruptible], the Philosopher here pursues this question according to his own opinion.

p 1-97

First he presents pre-notes needed in his investigation of the question;

Secondly, he pursues the question (L. 26).

p 1-97

About the first he does two things:

First he distinguishes various senses of the following words used in the question: namely, "generated" and "ungenerated," "destructible" and "indestructible";

Secondly, he distinguishes various senses of certain words used in the definitions of the foregoing: namely, "possible" and "impossible" (L. 25).

p 1-97

About the first he does two things:

First he reveals his intention;

Secondly, he carries it out, at 239.

p 1-97

About the first he does two things:

First he reveals his intention [†172] and says that in investigating the foregoing question it is first of all necessary to distinguish the various ways in which things are said to be "generable" and "ungenerable," "destructible" and "indestructible."

p 1-97

238. Secondly, at [†173] he reveals the reason for his intention and says that when things are said in a number of ways, it sometimes happens that this multiplicity produces no difference with regard to the argument proposed, i.e., when a particular word is restricted to one meaning in the course of the argument. But when a particular word is used with different meanings, such a multiplicity does make a difference. Even where there is no difference as to the argument, the intellect of the hearer becomes confused, if someone uses a word which can be distinguished in many ways as though it could not — for when someone uses a word of multiple meaning, it is not evident according to which signified essence the conclusion occurs.

p 1-97

239. Then at [†174] he distinguishes the aforesaid words:

First, "ungenerated" and "generated";

Secondly, "destructible" and "indestructible," at 243.

p 1-97

About the first he does two things:

First he distinguishes the word "ungenerated";

Secondly, the word "generated," at 241.

p 1-97

He declares first [†174] that this word "ungenerated" is used in three ways. The first of these is when something is called "ungenerated" which now exists but previously did not, yet this occurs without its having been begotten or transmuted. Some give the example of being touched or moved: for they assert that contact and motion are not generated. And this was proved in *Physics* V because, since generation is a kind of motion or transmutation, if motion were generated, it would follow that there would be a change of a change. Consequently, contact and motion, although they begin to be, are called "ungenerated," because they are not generated and are not apt to be generated.

p 1-98

In a second way something is said to be "ungenerated," if it is able to either come to be or not come to be and still it has not yet come to be. For example, a man to be born tomorrow is able, as far as the future is concerned, to come to be and not come to be, and yet he is said to be "ungenerated," because he has not yet been born. For "ungenerated," in the sense of "not generated," can be applied similarly to what is able to come to be, because it is not yet generated, and to what is not able to be generated.

p 1-98

In a third way something is said to be "ungenerated," when it is entirely impossible for it, through generation or any other way, to come into existence as being able either to exist or not exist. In this sense the word "ungenerated" describes things that cannot be or things that cannot not be. Now this third way is distinguished into two other ways, for there are two ways in which something is "impossible" to be or become: first, absolutely, when it is in no sense true to say that this may at some time come to be; secondly, when a thing is described as impossible to come about because it is not easy for it to come about, either because it does not come about quickly or because its coming into existence cannot be conveniently managed, as when we say that bad iron is not easy to fashion.

p 1-98

240. In order to understand these three ways it should be noted that generation has the common note of something's beginning to exist, and also implies a definite way of existing, namely, through transformation. Therefore the negation implied by the word "ungenerated" may either negate both, namely, both a beginning and the way of beginning, or it can negate only the way of beginning. And both can occur in two ways: in one way in the sphere of act, and in the other in the sphere of potency. Therefore, if the negation does not deny a beginning but merely the manner of beginning, we have the first meaning of the word according to which something is said to be "ungenerated," if it can begin to be but not through generation. But if it does not deny the possibility but merely the actual state, for example, because it can begin to be and can be generated, but has not yet begun to be or been generated, then it is the second sense of the word. But if it does not only deny the manner of its beginning, as in the first sense, or only the actual state of existence, as in the second sense, but both the manner of its beginning and the very beginning itself, both as to its actual state and even its possibility, then it is the third and most perfect sense, according to which something is said to be ungenerated in the strict and absolute sense. This sense, however, is still

distinguished according to whether something is said to be "possible" either absolutely or in a qualified sense.

p 1-98

241. Then at [†175] he distinguishes the meanings of the word "generated," and says that it is also in three senses that "generated" is used. The first of these occurs if something previously did not exist and later began to exist, either through generation, as man, or without generation, as contact, provided that the thing described as generated is something that one time is not and later is.

p 1-98

In a second way, something is described as "generated," if it is possible for it to begin to exist, where "possible" refers either to the truth, i.e., to what can exist, or to what is easy, i.e., can easily be made to exist.

p 1-99

In the third way, something is described as "generated," if it can be the subject of generation and proceeds thus from non-existence to existence. In this third sense it makes no difference whether the thing has already begun to be, and this by being made, i.e., through the process of generation, or whether it has not yet begun to be, but may come to be through generation.

p 1-99

In keeping with what has been said, the notion of these ways is apparent. Because when something is called "generated" in the first sense, its actual inception is asserted but not a definite mode of inception that the word "generation" signifies. But in the second sense the possibility of inception is asserted without asserting the definite way it began, which sense is distinguished according to the way "potency" is distinguished. However, the third way asserts not only inception but a definite kind of inception. And this third way can be further distinguished into two: for it asserts either a definite kind of inception that is actual, as when something is already generated, or one that is potential, as indicating something is naturally apt to be generated.

p 1-99

242. Now if anyone rightly considers the senses he has set down of the word "generated," he will see that they differ from the senses of "ungenerated" in two ways: first with respect to distinction, and, secondly, with respect to order.

p 1-99

With respect to *distinction:* In distinguishing the senses of "ungenerated," the denial of a definite kind of inception as possible was included under one sense and the denial of the same kind of inception as actual, was included under another sense — for in the first sense "ungenerated" referred to what could not begin to be through generation, but in the second it referred to what could begin to be through generation but had not yet been generated.

p 1-99

But in regard to the denial of inception in common, both the possibility and the actuality of inception are included under the same sense — for the third sense of "ungenerated" referred to what has both not begun to be and cannot begin to be. But conversely, in the senses of "generated" it is on the part of a beginning in common that he distinguishes the modalities according to potency and act — for the first sense refers to what actually begins to be in any way whatever, while the second sense refers to what can begin in any way, although it has not yet begun. However, with regard to a definite kind of inception, the actuality and possibility are included under one mode — for in the third sense something is described as "generated"

possibility are included under one mode — for in the third sense something is described as "generated" which either has been generated or can be generated. Thus it is plain that the last three senses are not exactly parallel to the first three, because what was distinguished in the first remains undistinguished in the second, and vice versa.

p 1-99

With respect to *order* these senses are different: For in presenting the modes of "ungenerated," that which pertains to a definite kind of inception was placed before that which pertains to inception in common, whereas in presenting the modes of "generated," that which pertains to inception in common was mentioned first. And Aristotle had a subtle reason for so doing. For he wanted to list the imperfect senses first and the perfect ones last. Now denial and affirmation are related to the proper and to the common in different ways: for a denial of what is proper is imperfect, but a denial of what is common is perfect, because when the common is denied, the proper is denied. Consequently, the last sense of "ungenerated" is presented as the perfect sense, because it denies inception in general. And because the denial of a particular kind of inception is imperfect, he presents the partial modes as distinguished according to potency and act.

p 1-100

But the affirming of what is proper is perfect, because in affirming what is proper that which is common is also affirmed, while the affirming of what is common is imperfect. Accordingly, the last sense of "generated" is presented as the perfect one, namely, when something begins to be through generation, and he includes under this sense, as under the perfect sense, both the possibility and the actuality. However, the senses pertaining to inception in general are presented first, as the imperfect senses: for a thing is not said to be "generated" in the perfect sense just because it has begun to be. For this reason he distinguished these modes, as partial, into one referring to possibility and another referring to actuality.

p 1-100

243. Then at [†176] he distinguishes the senses of "destructible" and "indestructible":

First, "destructible";

Secondly, "indestructible," at 245.

p 1-100

He says therefore first [†176] that "destructible" and "indestructible" are also said in many senses, and he presents three senses of "destructible." Now it should be noted that, just as generation implies inception in a definite way, so, too, destruction implies extinction in a definite way, namely, through transmutation. Consequently, the first sense of "destruction" is that of extinction in common without any distinction between possibility and actuality. And the reason for this order is the same as that used above for the word "generated": just as a thing is not said perfectly to be "generated" just because it begins to be, so a thing is not said perfectly to be "destroyed" just because it ceases to be, nor "destructible" just because it can cease to be.

p 1-100

Therefore the first sense in which we describe something as "destructible" is when it previously existed but later it either is not, or is able not to be, whether this is due to perishing and transmutation, as a man is perishable, or not through perishing and transmutation, as contact and motion cease to be.

p 1-100

In the second sense we describe something as "destructible," if it can *not be*, i.e., able at some time to cease to be, on account of a specific way of ceasing to be.

p 1-100

In the third sense, something is said to be "destructible," because it is easily destroyed, and can be called "*euphtharton,*" i.e., well destructible.

p 1-100

244. It should be observed that although the senses of "destructible" agree with those of "generated" as far as the order is concerned for just as in the latter there is placed first inception in general, so here there is placed first destruction in general, there is a difference in the way their modes are distinguished. For there the modes were distinguished according to possibility and actuality, but here they are distinguished according to absolute, and perfect, possibility, which latter is the last, as the most perfect mode — for the most perfectly destructible is what is easily destroyed. The reason for this is that "generated" is said according to act, while "destructible" according to potency. Hence "generated" can refer to both actuality and possibility, but "destructible" to possibility only.

p 1-100

The reason he set down "generated," which is according to act, and "corruptible," which is according to potency, is this: Since generation is from non-being to being, and corruption from being to non-being, that which is "generable" is not yet a being, but only that which has been "generated" is; on the other hand, that which is "corruptible" is a being, but that which has been "corrupted" is no longer a being. Now the intention of the Philosopher is to discuss a question, not of non-beings but of beings. And that is why he employs the words "generated" and "corruptible."

p 1-101

245. Then at [†177] he distinguishes the senses of "indestructible." And he presents three senses. The first of these denies a definite kind of extinguishing process, insofar as that is said to be "indestructible" which can cease to be in such a way that at one time it exists and later does not, but this without corruption. Examples are contact and motion which, after first existing do not later, but this is without their corruption, since things are subject neither to generation nor corruption. Consequently, this sense corresponds to the first sense of "ungenerated."

p 1-101

In a second sense something is called "indestructible," when extinction in common is denied. And he says that "indestructible" in this sense refers to what is now a being and it is impossible for it later not to be a being, or not to be in the future. This kind of indestructibility does not belong to any thing that can cease to be through corruption. For you, who can cease to be through corruption, exist now, and so does contact, which can cease to be, but not by corruption — yet both of these are called "corruptible" in a certain way, since a time will come when it will not be true to say that you exist, or that this is in contact. And, therefore, that is most properly called "indestructible" which is, indeed, a being but cannot be destroyed in such a way that, while it is a being now, later it will not be, or is able not to be, and although not yet destroyed can, nevertheless, eventually become non-existent. What is not so constituted is properly called "indestructible."

p 1-101

In a third sense, something is called "indestructible" which is not destroyed easily. And this corresponds to the third sense of "destructible," just as the second corresponds to the second, and the first to the first.

Lecture 25 (Aristotle's Text)

281a2-281a27

[178] This being so, we must ask what we mean by 'possible' and 'impossible'. [179] For in its most proper use the predicate 'indestructible' is given because it is impossible that the thing should be destroyed, i.e. exist at one time and not at another. And 'ungenerated' also involves impossibility when used for that which cannot be generated, in such fashion that, while formerly it was not, later it is. An instance is a commensurable diagonal. [180] Now when we speak of a power †1 to move †2 or to lift weights, we refer always to the maximum. We speak, for instance, of a power to lift a hundred talents or walk a hundred stades—though a power to effect the maximum is also a power to effect any part of the maximum—since we feel obliged in defining the power to give the limit or maximum. A thing, then, which is capable of a certain amount as maximum must also be capable of that which lies within it. If, for example, a man can lift a hundred talents, he can also lift two, and if he can walk a hundred stades, he can also walk two. But the power is of the maximum, [181] and a thing said, with reference to its maximum, †3 to be incapable of so much is also incapable of any greater amount. It is, for instance, clear that a person who cannot walk a thousand stades will also be unable to walk a thousand and one. [182] This point need not trouble us, for we may take it as settled that what is, in the strict sense, possible is determined by a limiting maximum. Now perhaps the objection might be raised that there is no necessity in this, since he who sees a stade need not see the smaller measures contained in it, while, on the contrary, he who can see a dot or hear a small sound will perceive what is greater. [183] This, however, does not touch our argument. The maximum may be determined either in the power or in its object. †1 The application of this is plain. Superior sight is sight of the smaller body, but superior speed is that of the greater body.

Lecture 25 (Aquinas' Commentary)

p 1-102
Lecture 25

How something is said to be "possible" and "impossible"

p 1-102
246. After pointing out the various senses of "generated" and "ungenerated," "destructible" and "indestructible," the Philosopher here explains the meaning of what is called "possible" and "impossible."

p 1-102
First he reveals his intention;

Secondly, he executes his plan, at 248.

p 1-102

About the first he does two things:

First he states what his intention is concerned with [†178], and says that since the situation is thus with regard to the meanings of "generated" and "ungenerated," "destructible" and "indestructible," it is necessary to consider how something is said to be "possible" and "impossible."

p 1-102

247. Secondly, at [†179] he gives the reason for his intention, namely, that "possible" and "impossible" are included in the definition of the aforesaid. For, as has been said above, that is most appropriately called "indestructible" which not only cannot be destroyed but can in no way exist at one time and later not exist. Similarly, "ungenerated" is appropriately applied to what is impossible, namely, to be and not to be, and which cannot come to be in any way such that previously it does not exist and later does exist. Thus, for the diagonal of a square to be symmetric, i.e., commensurate, to the side, is ungenerated, because it never can begin to be.

p 1-102

248. Then at [†180] he shows how something is described as possible and impossible. And it should be noted that, as the Philosopher says in *Metaph*. V, possible and impossible are said in one way absolutely, namely, because in themselves they can be true or cannot be true by reason of the relationship existing between the terms; in another way a thing is said to be possible or impossible *to something*, namely, what it is able for with respect to its active or passive power. And it is in this sense that "possible" and "impossible" are taken here, namely, as what is, or is not, within the power of an agent or patient — for this is the meaning that is most appropriate to natural things.

p 1-102

First, then, he shows how something is said to be "possible" or "impossible";

Secondly, he excludes an objection, at 251.

p 1-102

With respect to the first he does two things:

First he manifests how some thing is said to be "possible";

Secondly, how something is called "impossible," at 250.

p 1-102

249. To explain the first [†180] he says that if a thing is capable of something great, for example, if a man can walk 100 stades or can lift a great weight, we always determine or describe his power in terms of the most he can do. For example, we say that the power of this man is that he can lift a weight of 100 talents or can walk a distance of 100 stades, even though he is capable of all the partial distances included in that quantity, since he can do what exceeds. But his power is not described by these parts — we do not determine his power as being able to carry 50 talents or walk 50 stades, but by the most he can do. Consequently, the power of each thing is described with respect to the *end*, i.e., with respect to the ultimate, and to the maximum of which it is capable, and with respect to the strength of its excellence. Thus, too, the size of a thing is determined by what is greatest — for example, in describing the size of something that is three cubits, we do not say that it is two cubits. Similarly, we assign as the notion of man that he is rational, not that he is sensible, because what is the ultimate and greatest in a thing is what completes it and puts

upon it the stamp of its species.

p 1-103

Consequently, it is plain that one who can do what exceeds, necessarily can do what is less. For example, if a person can carry 100 talents, he can also carry two, and if he can walk 100 stades, he can also walk two; yet it is to what is excelling that the virtue of a thing is attributed, i.e., the virtue of a thing is gauged in terms of what is most excellent of all the things that can be done.

p 1-103

This is what is said in another translation, "the virtue is the limit of a power," because, namely, the virtue of a thing is determined according to the ultimate it can do. And this applies also to the virtues of the soul: for a human virtue is that through which a man is capable of what is most excellent in human actions, i.e., in an action which is in accordance with reason.

p 1-103

250. Then at [†181] he tells how something is said to be "impossible" to a thing. And he says that if some amount is impossible to someone if one takes what excels, it is plain that it will be impossible for him to carry or do more. For example, a person who cannot walk 100 stades clearly cannot walk 101. Hence, it is plain that just as the possibility is determined by the greatest that a thing can do — which determines its virtue — so what is impossible is determined by the least that it cannot do, and this determines its weakness. For example, if the most that someone can do is to go 20 stades, the least that he cannot go is 21 — and it is from this that his weakness is to be determined, and not from his inability to walk 100 or 1,000 stades.

p 1-103

251. Then at [†182] he excludes an objection.

First he proposes it;

Secondly, he solves it, at 252.

p 1-103

He says therefore first [†182] that nothing should disturb us in connection with the fact that what is properly called "possible" is determined according to the limit of excellence. Someone could, indeed, object that what has been said is not necessary in all matters — for there seems to be an objection in the case of sight and other senses. For a person who sees some large quantity, for example, something a stadium long, cannot for that reason see magnitudes of smaller size contained below that quantity. Rather it is more the opposite that occurs — for one who can see a "point," i.e., some smallest thing perceptible to sense, or hear a faint sound, can sense what is greater.

p 1-103

252. Then at [†183] he answers this objection and says that what was stated does not affect the argument whereby it is shown that the possible is determined by excellence. For the excellence according to which the virtue of a thing is measured can be determined according to the virtue, or according to the thing. According to the thing, when there is an excellence right in it, as was said about the 100 stades or the 100 talents. According to this excellence the active virtue is determined, because whatever can act on a greater thing can act on a lesser. But with respect to virtue, there is excellence when something which is not outstanding in quantity requires an excellence of virtue. And this is seen to occur especially with passive powers — for the more a thing is passible, the more it can be moved by what is less. And since the senses are passive powers, it happens in sensible things that one who can sense what is less can sense what is

greater.

p 1-103

What he has just said he explains as follows: a vision capable of perceiving a smaller body excels in virtue; hence the excellence in this case is an excellence in the virtue and not in the thing. But that speed is more excellent which is of a greater magnitude — for that is speedier which can traverse a greater distance in the same time — and such excellence is an excellence not only in the virtue, but also in the thing.

Lecture 26 (Aristotle's Text)

281a28-281b2

[184] Having established these distinctions we can now proceed to the sequel. If there are things capable both of being and of not being, there must be some definite maximum time of their being and not being; a time, I mean, during which continued existence is possible to them and a time during which continued non-existence is possible. And this is true in every category, whether the thing is, for example, 'man', or 'white', or 'three cubits long', or whatever it may be. For if the time is not definite in quantity, but longer than any that can be suggested and shorter than none, then it will be possible for one and the same thing to exist for infinite time and not to exist for another infinity. This, however, is impossible.

281b3-281b24

[185] Let us take our start from this point. The impossible and the false have not the same significance. One use of 'impossible' and 'possible', and 'false' and 'true', is hypothetical. It is impossible, for instance, on a certain hypothesis that the triangle should have its angles equal to two right angles, and on another the diagonal is commensurable. But there are also things possible and impossible, false and true, absolutely. [186] Now it is one thing to be absolutely false, and another thing to be absolutely impossible. To say that you are standing when you are not standing is to assert a falsehood, but not an impossibility. Similarly to say that a man who is playing the harp, but not singing, is singing, is to say what is false but not impossible. To say, however, that you are at once standing and sitting, or that the diagonal is commensurable, is to say what is not only false but also impossible. [187] Thus it is not the same thing to make a false and to make an impossible hypothesis; †1 and from the impossible hypothesis impossible results follow. [188] A man has, it is true, the capacity at once of sitting and of standing, because when he possesses the one he also possesses the other; but it does not follow that he can at once sit and stand, only that at another time he can do the other also. [189] But †2 if a thing has for infinite time more than one capacity, another time is impossible and the times must coincide. Thus if anything which exists for infinite time is destructible, it will have the capacity of not being. Now if it exists for infinite time let this capacity be actualized; †3 and it will be in actuality at once existent and non-existent. Thus a false conclusion would follow because a false assumption was made, but if what was assumed had not been impossible its consequence would not have been impossible. †4

281b25-281b31

Anything then which always exists is absolutely imperishable. [190] It is also ungenerated, since if it was generated it will have the power for some time of not being. For as that which formerly was, but now is not, or is capable at some future time of not being, is destructible, so that which is capable of formerly not having been is generated. †5 But in the case of that which always is, there is no time for such a capacity of not being, whether the supposed time is finite or infinite; for its capacity of being must include the finite time since it covers infinite time. †1

281b32-282a3

It is therefore impossible that one and the same thing should be capable of always existing and of always not-existing. †2 And 'not always existing', the contradictory, is also excluded. Thus it is impossible for a thing always to exist and yet to be destructible. Nor, similarly, can it be generated. For of two attributes if B cannot be present without A, the impossibility of A proves the impossibility of B. What always is, then, since it is incapable of ever not being, cannot possibly be generated.

Lecture 26 (Aquinas' Commentary)

p 1-104

Lecture 26

Everything eternal is indestructible and ungenerated

p 1-104

253. After explaining the meanings of the words proposed in the question, the Philosopher here begins to argue on the question proposed, namely, whether something can be generated and indestructible, or ungenerated and destructible.

p 1-104

First he shows with general arguments that this is impossible;

Secondly, with arguments proper to natural science, at 286 (L. 29).

p 1-104

About the first he does two things:

First he shows what follows from the preceding with respect to the present question;

Secondly, he begins to argue to his proposition, at 255.

p 1-104

254. He says therefore first [†184] that, the preceding having been determined as to the meanings of certain words, it is now time to state what follows in this treatment. For it has been said above that the "possible" is described in terms of something definite — for example, someone's power to run is described in terms of 100 stades. But there exist in external reality some things that can both exist and not exist. Therefore it is necessary according to the foregoing that there be determined some maximum time both affecting existence, such that it is not possible to exist for a greater time, and affecting non-existence, such that it is not possible not to exist for a greater time.

p 1-104

And lest this be understood as applying only to substantial existence, he adds that, when we say that it is possible or not possible for a thing to exist, or that which is able not to exist, such expressions can be understood with regard to any predication, i.e., with regard to any predicament: for example, that a man exist or not exist, which pertains to the genus of substance; or that white exist or not exist, which pertains to the genus of quality; or that "two cubits" exist or not exist, which pertains to the genus of quantity; or any other similar thing.

p 1-104

That when something is said to be able to be or not be, that expression must be understood in terms of

some determinate time, he now proves by leading to an impossibility. For, as he says, if there is not a time of determinate quantity in which it could be or not be, but a time greater than a given time is always assumed (for example, if it can be for fifty years and then more and again still more), and no limit is reached with respect to which every time in which it can be is less, then, since it is the same thing that can be and not be, as was said, it follows that the same thing can be for an infinite time, and not be for an infinite time, because the same reasoning applies to the non-existence as applies to the existence.

p 1-104

This does not mean that the time in respect to which something is able not to be, and which was concluded to be infinite, is the same as the time in respect to which the thing is able to be — because then the same thing would be able to be and not be during the same time, which is impossible, as will be said below. It means rather that there is one infinite time for the thing as non-existing, and another for it as existing. Now this is impossible: for there cannot be two infinite times, because then two times would be simultaneous. But this impossibility follows from saying that the possibility to be or the possibility not to be are not reckoned with respect to some determinate time. Therefore the first thing that must be clear is that the possibility of being is said with respect to a determinate time, and similarly the possibility of not being. And this agrees with what has been already laid down about the meaning of "possible."

p 1-105

255. Then at [†185] he begins to argue to his proposition. About this he does two things:

First he argues to it with general reasons;

Secondly, with an argument proper to natural science, at 286 (L. 29).

p 1-105

About the first he does two things:

First he shows the truth, namely, that indestructible and unproduced follow one upon the other; and likewise, destructible and generated;

Secondly, he disproves the contrary of this (L. 29).

p 1-105

Regarding the first he does two things:

First he proves his proposition by showing how what is eternal is related to the ungenerated and indestructible, and to the generated and destructible;

Secondly, how they are related to one another (L. 28).

p 1-105

About the first he does three things:

First he shows that everything eternal is indestructible and ungenerated;

Secondly, that nothing eternal is generated or destructible, nor conversely (L. 27);

Thirdly, he concludes that everything ungenerated and indestructible is eternal, at 265 (L. 27).

p 1-105

About the first he does two things:

First he presents some needed pre-notes;

Secondly, he argues to his proposition, at 257.

p 1-105

256. He says therefore first [†185] that in order to prove the proposition, it is necessary to start from the fact that "impossible" and "false" do not mean the same.

p 1-105

Regarding this he posits four reflections. The first is that both "possible" and "impossible," as well as "true" and "false," are used in two ways. In one way, *conditionally,* i.e., in the sense that a thing must be true or false, possible or impossible, if certain things are assumed; for example, a triangle must in fact have three angles equal to two right angles, but nevertheless such a property is impossible if certain things are assumed — thus, if we should suppose a triangle to be a square, it would follow that a triangle would have four right angles. In like manner, it will follow that the diagonal of a square is commensurate to the side if certain assumptions are true — for example, if we should assume that the square of the diagonal is 4 times the square of the side — for then it will always follow that the ratio of the diagonal to the side is a numerical proportion, which is a commensurable ratio. In a second way things are said to be *simpliciter,* i.e., absolutely and in themselves, "possible" and "impossible," "false" and "true."

p 1-106

The second he gives at [†186], and he says that to be false *simpliciter,* i.e., absolutely, and to be impossible absolutely, are not the same. For if I say that you are standing, whereas you are not standing but sitting, then what is said will be false but not impossible; likewise it will be false and not impossible if I say that the person playing the harp is singing, whereas he is not singing. But for someone to be standing and sitting at the same time, or for the diagonal to be commensurable with the side, is not only false, but impossible as well.

p 1-106

The third he gives at [†187] and he concludes it from the foregoing. For since the false and the impossible are not the same, it follows that it is not the same thing to assume what is false and to assume what is impossible: from the false there does not follow the impossible, but from the impossible there follows the impossible.

p 1-106

He gives the fourth at [†188]. And because it has been said that to stand and sit at the same time is impossible, he concludes that, although something may have at the same time the power to do the opposite things — for example, to sit and to stand — in the sense that now one power is actualized and now the other, nevertheless nothing has the power to have both simultaneously (for example, to stand and sit at the same time) but this must be at different times.

p 1-106

257. Then at [†189] he proves the proposition, namely, that everything eternal is indestructible and ungenerated.

First he shows that everything eternal is indestructible;

Secondly, that everything eternal is ungenerated, at 259.

p 1-106

He says therefore first [†189], as a conclusion from the foregoing (in which it was said that the "possible" is determined for some certain time), that if something is capable of several things during an infinite time, it cannot be said that one of them is possible at one time and another at another time, but whatever it is capable of is possible with respect to this time, because there is no time outside the infinite time. If therefore we should posit something existing in an infinite time to be destructible, from its destructibility it follows that it has the power not to exist at some time; and this must be understood with respect to the same infinite time in which it exists or in respect to some part of that time. Now since it exists in an infinite time and yet is supposed capable of not existing (since it is destructible), then let what is capable of not existing be such, i.e., let it be assumed not to exist, since you say that it is able not to exist. And because it had this capability (of not existing) with respect to infinite time, or some part of it, it follows that it simultaneously actually exists and does not exist — since it is assumed to be existing in infinite time, and later not to exist with respect to the same time.

p 1-106

It is plain that this falsity occurs on account of the false assumption that the thing existing in infinite time does not exist at some time. But if this falsehood were not something impossible, an impossibility would not follow. However an impossibility does follow, namely, that the same thing exists and does not exist at the same time. Therefore it was impossible for it not to exist. It had not been able, therefore, not to exist — and thus it was not destructible. Consequently it is plain that whatever is always an existing being cannot be destructible, and thus is absolutely indestructible.

p 1-107

258. But it seems that this reasoning of Aristotle does not conclude with necessity. For although nothing has the power to have two opposite things in existence at the same time, yet nothing prevents a thing from being at the same time capable of two opposites disjunctively, equally and in the same way. For example, I have the power to sit or to stand tomorrow at sun-up; not that both might take place at the same time but I am equally capable either of standing without sitting, or of sitting without standing. Hence someone could object to the argument of Aristotle thus: Let us suppose something always existing, yet in such a way that its eternity is contingent and not necessary. It would have the power therefore not to exist with respect to any part of the infinite time in which it is posited as always existing — yet it will not follow because of this that something is existing and not existing at the same time. For the same notion seems to be valid in infinite time and in some finite time. For although we might say that someone is always in his house throughout the whole day, it is not impossible for him not to be in the house at any part of the day — for he is not of necessity in the house throughout the whole day, but contingently.

p 1-107

But it must be answered that the same notion does not apply in both cases. For what exists always, i.e., through infinite time, has the power to exist in infinite time. But the power to exist is not undetermined to either alternative with respect to the time in which someone is able to exist — for all things seek to exist and each thing exists as long as it can. And this is particularly true in things of nature, because nature is determined to one. Consequently whatever exists always, does so not contingently but of necessity.

p 1-107

259. Then at [†190] he proves the same on the part of the generated or ungenerated. And he says that in like manner what exists always, i.e., in an infinite time, is necessarily ungenerated. If it were generated, it would be possible that at some time it not exist, as was said of the destructible — for just as the destructible is what, although previously existing, does not now exist or is able at some future time not to exist, so the generated is what now exists but previously was not. But there is, neither in finite time nor in

infinite time, any time in which what always exists is able not to exist — for what can exist in infinite time, just as what always exists, can exist in any finite time, which is included by infinite time. Accordingly, it will follow, according to the aforesaid deduction, that something simultaneously exists and does not exist, which is impossible. Therefore it does not happen that one and the same thing is able always to exist and always not to exist — since this would be the same as always to exist and always not to exist for an infinite time.

p 1-107

Likewise it is not possible to deny the existence of what always exists, for example, to say that what always exists is able not always to exist: for this would imply the possibility of not existing at least for a finite time.

p 1-107

Thus it is plain that it is impossible for something always to exist and to be destructible, or also to be generated. If there are two terms so related that the second cannot exist without the first, as man cannot be without being an animal, then, if the first cannot be, it follows that the second cannot be — just as, if it is impossible for a stone to be animal, it is impossible for a stone to be man. Now not to be at some time follows the destructible and the generated as something more common, as is plain from what was said. Therefore, if what exists always cannot at some time not exist, it follows also that it is impossible for what always exists to be generated, and likewise that it is impossible for it to be destructible. Consequently, it is plain that everything eternal is ungenerated and indestructible.

Lecture 27 (Aristotle's Text)

282a4-282a13

[191] But since the contradictory of 'that which is always capable of being' is 'that which is not always capable of being'; while 'that which is always capable of not being' is the contrary, whose contradictory in turn is 'that which is not always capable of not being', [192] it is necessary that the contradictories of both terms should be predicable of one and the same thing, and thus that, intermediate between what always is and what always is not, there should be that to which being and not being are both possible; [193] for the contradictory of each will at times be true of it unless it always exists. Hence that which not always is not will sometimes be and sometimes not be; and it is clear that this is true also of that which cannot always be but sometimes is and therefore sometimes is not. †3 One thing, then, will have the power of being and of not being, and will thus be intermediate between the other two.

282a14-282a21

[194] Expressed universally our argument is as follows. Let there be two attributes, *A* and *B*, not capable of being present in any one thing together, while either *A* or *C* and either *B* or *D* are capable of being present in everything. Then *C* and *D* must be predicated of everything of which neither *A* nor *B* is predicated. Let *E* lie between *A* and *B;* for that which is neither of two contraries is a mean between them. In *E* both *C* and *D* must be present, for either *A* or *C* is present everywhere and therefore in *E*. Since then *A* is impossible, *C* must be present, and the same argument holds of *D*. †1

282a22-282b1

[195] Neither that which always is, therefore, nor that which always is not is either generated or destructible. And clearly whatever is generated or destructible is not eternal. If it were, it would be at once capable of always being and capable of not always being, but it has already been shown †2 that this is impossible. [196] Surely then whatever is ungenerated and in being must be eternal, and whatever is indestructible and in being must equally be so. †3(I use the words 'ungenerated' and 'indestructible' in their proper sense, 'ungenerated' for that which now is and could not at any previous time have been truly said not to be; 'indestructible' for that which now is and cannot at any future time be truly said not to be.†4 [197] If, again, the two terms are coincident, †5 if the ungenerated is indestructible, and the indestructible ungenerated, then each of them is coincident with 'eternal'; anything ungenerated is eternal and anything indestructible is eternal.

Lecture 27 (Aquinas' Commentary)

p 1-108

Lecture 27

Nothing eternal generated and corrupted, and conversely.

 p 1-108

260. After showing that everything eternal is ungenerated and indestructible, the Philosopher here compares the eternal to the destructible and the generated, and shows that they cannot be at the same time.

 p 1-108

First he prefaces certain things from which the argument proceeds;

Secondly, from these he argues to his proposition, at 264.

 p 1-108

Regarding the first he proposes three things. First, indeed, he sets out the opposition between "always to be" and "always not to be" [†191]; and although he includes "possible," he does not discuss the opposition according to "possible" and "not possible," but only that between "always being" and "not always being." He says therefore first that the contradictory denial of the affirmation "possible always to be" is "possible not always to be": this negation is taken not on the part of "possible," in regard to which "possible not always to be" is affirmative, but on the part of "not always to be." But "possible always not to be" is opposed contrarily (according to the same mode) to what is "possible always to be," the negative of which is "possible not always not to be."

 p 1-108

The reason for this is that this adverb, *always*, designates universality of time, just as the sign, *every*, designates a universality of subjects. Hence, just as the contradictory of the statement,"Every man is," is "Not every man is," which is equivalent to "Some man is not," whereas the contrary of "Every man is," is "Every man is not," which is equivalent to "No man is," whose contradictory is "Not every man is not," which is equivalent to "Some man is"; so the contradictory of "always to be" is "not always to be," which is equivalent to "not to be at some time"; whereas the contrary of "always to be" is "always not to be," which is equivalent to "never to be," whose contradictory is "not always not to be," which is equivalent to "sometime to be."

 p 1-108

261. Secondly, at [†192] he concludes from the aforesaid manner of opposition that the same subject must possess the negations of both, i.e., of "always to be" and "always not to be," which negations are "not always to be" and "not always not to be." These negations are present in the same way in the same subject which is the medium between always being and always not being, which indeed can at one time be and at another time not be, as if we should say that between "Every man is," and "no man is," the medium is "Some man is" and "Some man is not."

 p 1-108

262. Thirdly, he proves that this conclusion follows from the foregoing. First, by a proper argument based on the notion of the terms appearing in the question, to the effect that the negation of both, namely, both of that which is "always to be" and that which is "always not to be," will at some time exist, i.e., posits something existing at some time, if it does not always exist, i.e., if by negation something is not posited always. For example, this negation "not always to exist" does not posit an eternal state either of being or of non-being; consequently, it posits to exist at some time, and at some time not to exist. And the same applies to the negation, "not always not to exist." He concludes therefore that what is not always non-existent will at one time be and at another time not be, because thus is denied "always not to exist" without positing the thing in question always to exist. Likewise the negation, "not always able to be," since it removes eternity of existence in such a way as not to posit eternity of non-existence, does posit "existence at some time." And because it does not posit eternal existence, there is nothing to prevent its not existing. Therefore

"possible to be at some time" and "not to be some time" will be the same. And this is the medium between the two contraries, "always to be" and "always not to be."

p 1-109

263. Secondly, at [†194] he proves the same thing with a common reason which, namely, applies to any terms. Let then A and B be two terms such that they can be found in no same thing, because they are contrary, as in the case of "always to be" and "always not to be." Take another term G, which is so related to A, that in every subject there must be either A or G — they being related as affirmation and negation, as, for example, "always existing" and "not always existing." Then take another term D which is related to B in the same way as "always not existing" [B] is related to "not always not existing" [D]. It is necessary, therefore, that in everything which is neither A nor B, i.e., everything which neither always exists nor always does not exist, there inhere both G and D, which are the negations of both — since to that from which is removed "always existing" and "always not existing," there is necessarily attributed "not always existing" (i.e., "at some time not to be"), and "not always not existing" (i.e., "to be some time"). Consequently that subject from which both affirmations are removed and to which both negations are applied is a medium between A and B — for what denies both extremes is a medium between two contraries, as, for example, what is neither white nor black, is intermediate between white and black. In such a medium must necessarily exist both negations, namely, G and D. For, as was said, either G or A exists in everything whatsoever; consequently, one of them exists in E. Since, then, A cannot exist in E, it follows that G exists in E. And arguing on the same lines, D must exist in E. Thus, therefore, both G and D are predicates of E, from which both A and B are removed — since, namely, that at one time exists, and at another time does not, which neither always exists nor always does not exist. And this is what he intended to prove.

p 1-109

264. Then at [†195] from these premises he argues to his proposition. For if something always exists it is neither generated nor destructible; similarly, if something is always non-existent, it is neither generated nor destructible. Now it is manifest that also conversely, if something is generated or destructible, it is not eternal, either in respect to existing or in respect to non-existing. For if we assume the opposite as true, namely, that something is at once eternal and generated and destructible, it will follow that something is at once capable of always being and not always being, because the eternal can always exist but the generated and corruptible does not always exist. Now the impossibility of this was pointed out before: it was said that "always to exist" and "not always to exist" are opposed as contradictories. Hence what is left is that it is impossible for anything to be at once eternal and corruptible or generated.

p 1-109

265. Then at [†196] he shows that everything ungenerated and indestructible is eternal. First he concludes this from the premises and says that it is necessary for everything ungenerated to be eternal, and likewise for everything indestructible to be eternal, provided it be being, and provided that "ungenerated" and "indestructible" are taken in their proper sense. The proper sense of "ungenerated" denotes something which now exists in such a way that it was not previously true to say that it did not exist; and "indestructible" denotes what now exists in such a way that it will not later be true to say of it that it does not exist. This is clear from what was said in distinguishing these words above.

p 1-110

266. Secondly, he proves the same point from what will be shown below. And he says that if "ungenerated" and "indestructible" are so related that everything ungenerated is indestructible and vice versa, then "eternal" must follow both, i.e., whatever is indestructible is eternal.

p 1-110

From all the foregoing the following argument can be formed: Nothing eternal is generated or destructible. Everything ungenerated and everything incorruptible is eternal. Therefore nothing ungenerated is destructible, and nothing indestructible has been generated.

Lecture 28 (Aristotle's Text)

282b1-282b5

[198] This is clear too from the definition of the terms. Whatever is destructible must be generated; for it is either ungenerated or generated, but, if ungenerated, it is by hypothesis †1 indestructible. [199] Whatever, further, is generated must be destructible. For it is either destructible or indestructible, but, if indestructible, it is by hypothesis ungenerated.

282b6-283a1

[200] If, however, 'indestructible' and 'ungenerated' are not coincident, there is no necessity that either the ungenerated or the indestructible should be eternal. [201] But they must be coincident, for the following reasons. The terms 'generated' and 'destructible' are coincident; [202] this is obvious from our former remarks, since between what always is and what always is not there is an intermediate which is neither, and that intermediate is the generated and destructible. For whatever is either of these is capable both of being and of not being for a definite time: in either case, I mean, there is a certain period of time during which the thing is and another during which it is not. Anything therefore which is generated or destructible must be intermediate. [203] Now let A be that which always is and B that which always is not, C the generated, and D the destructible. Then C must be intermediate between A and B. For in their case there is no time in the direction of either limit, †2 in which either A is not or B is. But for the generated there must be such a time either actually or potentially, though not for A and B in either way. C then will be, and also not be, for a limited length of time, and this is true also of D, the destructible. Therefore each is both generated and destructible. Therefore 'generated' and 'destructible' are coincident. [204] Now let E stand for the ungenerated, F for the generated, G for the indestructible, and H for the destructible. As for F and H, it has been shown that they are coincident. But when terms stand to one another as these do, F and H coincident, E and F never predicated of the same thing but one or other of everything, and G and H likewise, then E and G must needs be coincident. For suppose that E is not coincident with G, then F will be, since either E or F is predicable of everything. But of that of which F is predicated H will be predicable also. H will then be coincident with G, but this we saw to be impossible. And the same argument shows that G is coincident with E.

283a2-283a3

Now the relation of the ungenerated *(E)* to the generated *(F)* is the same as that of the indestructible *(G)* to the destructible *(H)*.

Lecture 28 (Aquinas' Commentary)

p 1-111

Lecture 28

Generated and corruptible, ungenerated and incorruptible, follow on each other

p 1-111

267. After proving his proposition above on the part of what is eternal, the Philosopher now proves the same thing on the part of the generated and ungenerated, the destructible and indestructible.

p 1-111

First he proves it from a supposition;

Secondly, with necessity, at 271.

p 1-111

About the first he does two things:

First, on the supposition that ungenerated and indestructible are convertible terms, he proves that generated and destructible are convertible;

Secondly, he shows whence the conversion of ungenerated and indestructible is to be supposed, at 270.

p 1-111

268. He says therefore first [†198] that what we are pursuing can be made clear from their determination, i.e., from the way these terms are distinguished one from the other and related one to the other. First he shows that "generated" follows upon "corruptible," in such a way that if something is corruptible, then necessarily it was generated. For the corruptible must be either generated or ungenerated, because one of these two must be predicated of anything that exists. If, therefore, something is destructible which was not generated, it follows that it is ungenerated. But we are assuming that "ungenerated" and "indestructible" are convertible, i.e., that if something is ungenerated, it will be indestructible. Consequently, if there exists a destructible thing that was not generated, it follows that something destructible is indestructible.

p 1-111

269. Secondly, he proves in the same way that if something is generated, it is necessarily destructible. For what is generated must be either destructible or not. But we are supposing that if something is indestructible it is ungenerated, because these are convertible. It follows, therefore, that there is something generated which is ungenerated, which is impossible.

p 1-111

Thus is proved that whatever is destructible is generated and vice versa, on the supposition, of course, that ungenerated and indestructible are convertible terms.

p 1-111

270. Then at [†200] he shows why this must be supposed. And he says that if "indestructible" and

"ungenerated" do not follow one upon the other, then "to be eternal" will not necessarily follow upon being ungenerated and being indestructible. But it has been proved above that it does.

p 1-111

271. Then at [†201] he proves his proposition from necessity.

First he shows that "generated" and "destructible" are convertible;

Secondly, from this he further shows that "ungenerated" and "indestructible" are also convertible, at 275.

p 1-111

Concerning the first he does three things:

First he reveals his intention, and says that from what will be said, it will be plain that the foregoing things follow one upon the other. It will first be shown that generated and destructible follow one upon the other.

p 1-112

272. Secondly, at [†202] he presents an argument to prove this, and says that just as the convertibility of "indestructible" and "ungenerated" is plain from what was previously said, so, too, the convertibility of "generated" and "destructible." For between "always existing" and "always not existing" there is a middle (as was said above), namely, that which follows neither, i.e., what neither always is nor always is not. Now such are the "generated" and "destructible," because both are able to be and not to be with respect to some determinate time, in such a way, namely, that for some finite time both exist and for some other finite time both do not exist. If then there is something which is generated or is destructible, such a thing must be a middle between what always exists and what is always non-existent. Consequently both terms will apply to the same thing and they are found to follow one upon the other.

p 1-112

273. Thirdly, at [†203] he manifests the foregoing argument by using terms, and says: Let A be something that always exists, and B something that is always non-existent, whereas G is something generated and D something destructible. Then G is necessarily intermediate between A and B, i.e., between what always exists and what always is non-existent; for in regard to A and B there is no time at either terminus, i.e., either before or after, in which A, which is always existing, does not exist, or B, which is always non-existent, exists. But in regard to the generated, there must be some time in which it does not exist, either at both termini or at one of them, and likewise some time in which it does, and this either actually or potentially; but with regard to A and B there can be no opposite time in either way, i.e., either actually or potentially. What is left, therefore, is that the generated G exists for some definite time and for some definite time does not exist; and the same goes for D. It follows, therefore, that both are generated and destructible, i.e., in such a way that the generated thing is both, and the destructible is both. Thus it is plain that "generated" and "destructible" follow one upon the other.

p 1-112

274. But this argument does not seem to be valid: for it is not necessary that a middle between two contraries be one and the same thing. For the middle between white and black is indeed something neither white nor black; yet this is said of many different things which do not follow one upon the other. For red and pale and any of the intermediate colors are neither white nor black, and yet they do not follow one upon the other. Consequently, someone could say that the intermediate between "always existing" and "always not existing" is something which neither always exists nor always does not exist, but that this belongs to the "destructible" in one way and to the "generable" in some other way: for the "generated" has no existence before it exists, while the "destructible" has no existence after it has existed.

But this objection is excluded by the very fact that he says that it is in some definite time that each of them exists and does not exist. Thus both of them have to have existence after non-existence, and before non-existence. And this will be made clearer in the following lecture.

275. Then at [†204] he shows from the foregoing that "ungenerated" and "indestructible" are also convertible, saying: Let E be ungenerated, Z generated, I indestructible and T destructible. Since it has been shown that "generated" and "destructible" follow upon each other, it is plain that Z and T follow upon each other. Now supposing that Z and T follow upon one another, namely, "generated" and "destructible," and assuming that E and Z, i.e., the "generated" and "non-generated," are not present in the same subject, but that one of them must be present in every subject, and the same for T and I, i.e., the "destructible" and "indestructible," namely, that they are not both present in any same subject, but one of them must be present in any subject, then, such suppositions having been made, it is necessary that I and E, i.e., the "non-generated" and "indestructible," follow one upon the other.

This he proves by leading to an impossibility. For if E, which is to be non-generated, does not follow necessarily upon I, which is to be indestructible, it will follow that Z, which is generated, can co-exist with I, which is indestructible, because it has already been established that of everything is predicated either E, i.e., non-generated, or Z, i.e., generated. Moreover it has been stated that whatever is Z, i.e., generated, is also T, i.e., destructible. Consequently, it will follow that T, i.e., destructible, is found in that which is I, i.e., indestructible. But that is contrary to the assumption that T and I are never present in the same thing — for nothing is destructible and indestructible. And the same reasoning shows that I, i.e., indestructible, follows upon E, i.e., non-generated, because the non-generated, E, is related to generated, Z, in the same way as indestructible, I, is related to destructible, T. Thus it is plain from the foregoing that whatever is destructible was generated and vice versa; and that what is indestructible is non-generated and vice versa.

Lecture 29 (Aristotle's Text)

283a4-283a23

[205] To say then that there is no reason why anything should not be generated and yet indestructible or ungenerated and yet destroyed, to imagine that in the one case generation and in the other case destruction occurs once for all, is to destroy part of the data. †1 For (1) everything is capable of acting or being acted upon, of being or not being, either for an infinite, or for a definitely limited space of time; and the infinite time is only a possible alternative because it is after a fashion defined, as a length of time which cannot be exceeded. But infinity in one direction is neither infinite nor finite. [206] (2) Further, why, after always existing, was the thing destroyed, why, after an infinity of not being, was it generated, at one moment rather than another? If every moment is alike and the moments are infinite in number, it is clear that a generated or destructible thing existed for an infinite time. It has therefore for an infinite time the capacity of not being (since the capacity of being and the capacity of not being will be present together),†1 if destructible, in the time before destruction, if generated, in the time after generation. If then we assume the

two capacities to be actualized, opposites will be present together. †2[207] (3) Further, this second capacity will be present like the first at every moment, so that the thing will have for an infinite time the capacity both of being and of not being; but this has been shown to be impossible. †3[208] (4) Again, if the capacity is present prior to the activity, it will be present for all time, even while the thing was as yet ungenerated and non-existent, throughout the infinite time in which it was capable of being generated. At the time, then, when it was not, at that same time it had the capacity of being, both of being then and of being thereafter, and therefore for an infinity of time. †4

283a24-283a28

[209] It is clear also on other grounds that it is impossible that the destructible should not at some time be destroyed. For otherwise it will always be at once destructible and in actuality indestructible, †5 so that it will be at the same time capable of always existing and of not always existing. Thus the destructible is at some time actually destroyed. The generable, similarly, has been generated, for it is capable of having been generated and thus also of not always existing. †1

283a29-283b5

[210] We may also see in the following way how impossible it is either for a thing which is generated to be thenceforward indestructible, or for a thing which is ungenerated and has always hitherto existed to be destroyed. Nothing that is by chance can be indestructible or ungenerated, since the products of chance and fortune are opposed to what is, or comes to be, always or usually, while anything which exists for a time infinite either absolutely or in one direction, is in existence either always or usually. That which is by chance, then, is by nature such as to exist at one time and not at another. But in things of that character the contradictory states proceed from one and the same capacity, the matter of the thing being the cause equally of its existence and of its non-existence. Hence contradictories would be present together in actuality. †2

283b6-283b16

[211] Further, it cannot truly be said of a thing now that it exists last year, nor could it be said last year that it exists now. †1 It is therefore impossible for what once did not exist later to be eternal. For in its later state it will possess the capacity of not existing, only †2 not of not existing at a time when it exists—since then it exists in actuality—but of not existing last year or in the past. Now suppose it to be in actuality what it is capable of being. It will then be true to say now that it does not exist last year. But this is impossible. No capacity relates to being in the past, but always to being in the present or future. It is the same with the notion of an eternity of existence followed later by non-existence. In the later state the capacity will be present for that which is not there in actuality. †3 Actualize, then, the capacity. It will be true to say now that this exists last year or in the past generally.

283b17-283b25

[212] Considerations also not general like these but proper to the subject show it to be impossible that what was formerly eternal should later be destroyed or that what formerly was not should later be eternal. Whatever is destructible or generated is always alterable. Now alteration is due to contraries, and the things which compose the natural body are the very same that destroy it. †4

Lecture 29 (Aquinas' Commentary)

p 1-114

Lecture 29

Refutation of corruptible ungenerated and incorruptible generated. Argument from natural science.

p 1-114

276. After showing that "generable" and "destructible" follow one upon the other and likewise "non-generated" and "indestructible," the Philosopher here refutes the contrary opinion, on the ground that from such a contrary opinion some of the assumed principles must be destroyed.

p 1-114

First he shows how such a position destroys the supposition that every power is referred to a determinate time;

Secondly, he shows that it destroys the supposition that the same thing cannot simultaneously be and not be, at 279.

p 1-114

277. He says therefore first [†205] that since it has been demonstrated from certain presupposed principles that every generated thing is destructible, and every non-generated is indestructible, and vice versa, consequently, whoever declares there is nothing to prevent a thing that was made or generated from being indestructible, or something non-generated from being destroyed, in such a way, however, that one of these, namely, the generated, is generated but once, and the other, namely, the destructible, is destroyed but once, without their being alternately generated and destroyed, necessarily destroys thereby one or the other of the principles that were presupposed. For if a conclusion follows syllogistically from the premises, the conclusion which follows with necessity from the premises cannot be destroyed, unless one of the premises be destroyed.

p 1-114

Now he seems to state this against Plato, who posited that the world was made but is indestructible, and consequently posited that the disorder from which the world was generated was ungenerated but destructible — although some say that Plato did not understand this in the way his words sound, against which meaning Aristotle is here disputing. But so far as the exposition of this book is concerned it makes no difference whether Plato felt this way or that, provided it becomes clear how this position is being refuted by the arguments of Aristotle.

p 1-114

278. So he takes up again one of the given principles from the assumption of which he had argued to the proof of his proposition. And he says that all things having a certain power can do something or be acted upon, or be or not be, in accordance with their power, either for an infinite time, or for some time of definite quantity, i.e., for a period of time that is absolutely finite. And because he had previously mentioned the meaning of power only with respect to a determinate time, he adds that the reason why things having power can do or be something for an infinite time is that even infinite time is in a sense determinate, namely, by reason, in such a way that no diversity can be found in it — since the infinite is "that of which there is not more," i.e., than which something greater cannot be taken. This is notwithstanding the fact that in *Physics* III Aristotle refutes this definition of the infinite, saying that it is rather a definition of the whole and of the perfect, whereas the infinite is imperfect and after the manner of a part. For there Aristotle is speaking of the infinite with respect to that of it which is in act, to which

addition can always be made; but here he is speaking of it with respect to all that is of it in potency, and to which nothing can be added. And such is also the condition of time, about which we are now speaking — since time is not all at once but successive.

p 1-115

Now a time which is infinite in some respect [*quo*], i.e., in a qualified sense, namely, with respect to its beginning or its end, is neither absolutely infinite, because there can be more of it, nor absolutely determinate, because it does not have some certain quantity. And therefore, according to the aforesaid supposition, it cannot be that something have the power of doing or being acted upon, or of being or not being, for a time that is finite at one end and infinite at the other. But whoever declares that something is non-generated but destructible, or generated and indestructible, is positing that something has the power to be or not be for a time that is in one respect infinite and in another respect finite. Therefore he is destroying the aforesaid supposed principle.

p 1-115

279. Then at [†206] he shows that the above-mentioned position destroys still another principle that was assumed, namely, that it is impossible for the same thing to be and not to be. About this he does two things:

First he proves his proposition from the viewpoint of the potency existing in what is assumed to be generated or destroyed;

Secondly, from the cause of the same, at 284.

p 1-115

About the first he does two things:

First he shows that to suppose the non-generated to be destroyed, or something generated to be indestructible, implies that something can at the same time be and not be;

Secondly, he shows that the same impossibility follows from the supposition that something destructible exists which is not destroyed, at 283.

p 1-115

In regard to the first he presents three arguments. With respect to the first of these he says: If we posit that something ungenerated first always existed and later was destroyed at a certain sign of time, i.e., at some certain instant, no reason can be assigned why it should be destroyed in that instant rather than in any other of the infinite previous instants. Likewise if for an infinite time something was not existing and then came to be at a certain instant, no reason can be assigned why it could be or come to be more in that instant than in any of the infinite preceding ones.

p 1-115

If the preceding time were supposed finite, a reason could be assigned, because it could be said that the thing had the power to exist or not exist for such and such a time and no more. But due to the fact that the thing is described as having existed or not having existed for an infinite time, the above reason ceases. And therefore it is necessary to posit that the ungenerated could have not existed in each of the instants of the preceding time, and similarly that the generated thing was able to exist in each of the instants of the preceding time. For if there is nothing more, i.e., no better reason why it was able to be or not to be in that instant rather than any of the preceding, since infinite signs, i.e., an infinitude of instants preceded, it is plain that during that infinite time something will be generable in the sense that it could have been generated at any instant of that infinite time. And similarly it must be said that in each instant of that time the thing

at any instant of that infinite time. And similarly it must be said that in each instant of that time the thing assumed ungenerated and later destroyed was destructible. Consequently it is plain that the thing assumed as pre-existing for an infinite time also had the potency not to be in that whole infinite time. It will follow therefore that something will simultaneously, i.e., at one and the same time, have the power to be and not be, in such a way, however, that on the part of what is ungenerated and destructible the existence preceded the nonexistence, whereas on the part of what is generated and indestructible, the existence is after the non-existence. Now there is nothing to prevent us from assuming what is possible. If, then, we assume with regard to the ungenerated that it did not exist during that time in which it existed and was able not to exist, it will follow that opposites co-exist, namely, that it existed and did not exist at the same time. Consequently, the aforesaid supposition destroys what had been presupposed, namely, that it is impossible for the same thing to be and not be at the same time.

p 1-116

280. But this reason does not seem compelling. For nothing prevents what is possible, absolutely speaking, from being impossible under certain conditions. For example, if we suppose that Socrates is at some time seated, it is possible, absolutely speaking, for him not to be seated at that time, although it is not compossible. In like manner, it can be said that what has been existing for an infinite time had the power not to exist during that time — but not, however, in the sense that its non-existence is compossible with what was posited, namely, that it could be simultaneously with its actual being.

p 1-116

Now it should be stated that nothing prevents what is incompossible to that which is contingent from being absolutely possible, yet what is incompossible to that which absolutely must be, is absolutely impossible. That which exists naturally through an infinite time exists necessarily — since it is necessary that each thing be to the extent that the nature of things provides for it, for nothing ceases to be except when it can no longer be, since all things long to be. Hence if something is presented as possible to be, then by that very fact it is necessary to posit it as compossible to that which must be. Therefore if we posit that what has always existed was able not to exist all during that time, it follows that it was able at once to be and not be.

p 1-116

281. He gives the second argument at [†207] and says that what always existed, or always did not exist, is according to the foregoing presumed to have possessed a power opposite to what was in it, not at some sign or instant, but absolutely at every sign, i.e., at every instant. Consequently, it follows that for an infinite time something would have the power to be and not be, which is impossible, as was proved above.

p 1-116

282. He gives the third argument at [†208] which is this: In that which begins to be after it had not been, or not to be after it had been, the power or potency precedes the act. Accordingly, if something that always existed was ungenerated, it follows that it always had the potency not to exist — for there is no reason why that potency of non-being should have come to it after an infinite time. Similarly, even if there be something generated which for an infinite time did not exist, it follows that during that entire time it was able to come into existence, so that at the same time that it was not existing, it had the power to be and not be this, and that it would be later for an infinite time, since we are assuming that it is indestructible.

p 1-117

Consequently, since for the infinite time before it existed it had the power to exist for an infinite time in the future, there was no reason why it could exist in that instant and not before, since it is not in potency to exist in a determinate time. What is left, therefore, is that it could have existed even at some time before it existed; thus it had the power to exist in that time in which it was not existing, and so it follows, according to the premises, that it was able to be and not be at the same time. And the same argument applies to what is assumed to have always been and is at a certain time destroyed.

p 1-117

283. Then at [†209] he concludes according to the same reasoning that it is impossible for something to be destructible and not be destroyed at some time. For someone could object to the foregoing arguments and say that everything generated is destructible according to its nature, but it can happen that what is destructible may never be destroyed, because some cause is preserving its existence, as Plato assumed that the world is in itself generated and destructible, but will always remain, because God wills it. (Some say that Plato did not understand that the world is destructible, as though it had within itself the necessary cause of its destruction, but that he described it in that way because he wanted to point out that it depends for its existence on another, i.e., that the necessity of its existence is not in it of itself but from God. But whatever Plato may have understood makes no difference to the present undertaking, since Aristotle is objecting to his words.) Hence he says that it is plainly impossible for something destructible not to be at some time destroyed. Because if it will not be destroyed at some time, it has the power not to be destroyed and thus will be indestructible; and yet it is assumed to be a destructible thing existing for an infinite time. Consequently, it will be always, i.e., for an infinite time, simultaneously actually destructible and indestructible. But what is destroyed does not exist forever, whereas the indestructible does exist forever. Therefore there will be something capable at the same time of always existing and not always existing. But that is impossible, as is plain from what was said above, because what can always exist, necessarily exists always, and hence cannot be not always existing. Consequently, it is clear that everything destructible will be destroyed sometime.

p 1-117

Similarly, if something is of its very nature generable, it is necessary that it be made. This does not mean that everything that can be generated will be generated at some time, for there are many things possible that will never be generated. But it cannot be that something now existing have a nature that is generable, and not have been generated, but have pre-existed from eternity. For what is generable does not have the natural power of always existing but of being able to be after it was at some time made. That is why he does not say that if it is generable, it *will* be made, but *has been* made.

p 1-117

284. Then at [†210] he proves the same from the viewpoint of the cause of what is assumed ungenerated and indestructible.

First he presents his argument;

Secondly, he rejects an objection, at 286.

p 1-117

He says therefore first that, as will be said, we may also see in the following way that it is impossible either for a thing which is at some time generated to be thenceforward indestructible, or for a thing which is ungenerated and has always hitherto existed, to be destroyed. What is indestructible or ungenerated cannot exist by chance — since the product of chance or fortune neither exists nor comes to be as that which is always or usually. Meanwhile, anything which exists in infinite time, either absolutely finite or infinite in one direction, namely, before or after, is in existence either always, as is that which exists in infinite time absolutely, or for the most part, as is that which is in infinite time as to one part. Therefore it is necessary that such things which are either generated or corrupted after an infinite time, have from nature that they will at some time be and at some time not be. But in things which at one time naturally are and at another are not, the same power is directed to contradictories, namely, to being and not being, since this characteristic of at some time being, and at some time not being, is had from matter inasmuch as it is subject to privation or form. Thus the same thing follows as before, namely, that opposites could exist in

the same thing at the same time. For in what has been generated a matter in potency to non-existence remains — and so, since it is indestructible, it will at the same time be able to be and able not to be. And the same holds for the ungenerated.

p 1-118

285. Then at [†211] he excludes a certain objection. For someone could say that that indestructible thing which is generated has the power of not existing, not indeed with respect to the future, but with respect to the past; similarly what is ungenerated but destructible possesses a potency to existence with respect to the past.

p 1-118

But he excludes this by saying that it is not true to assert now that it is at the present time last year, or any of the things which were in past time; nor can it be said that what exists now existed in the past year — for things are distinguished in time in such a way that the order of time cannot be reversed so as to make the past the present or attribute present things to the past. From this it is plainly impossible for something which at one time did not exist, later to have existence forever, as we have already concluded from the preceding argument. For by reason of the matter from which it was made it has the potency not to exist even after it does exist: but it cannot be said that it has the potency not to exist now, because it is already existing in act and thus opposites would co-exist, as was concluded in the previous arguments. But it follows that it has the potency to non-existence in regard to the past year or past time. But this is impossible as the following argument shows: That for which a thing has the potency or power can be made actual. If, therefore, it is possible for something with respect to past time either to be or not be, we can posit that last year was not, i.e., that what existed last year was not existing then. But this is impossible, as was set down previously, for no potency looks to what was made in the past, but to what is in the present or what will be.

p 1-118

And what has been said in regard to something generated but assumed incorruptible applies also if something is assumed as previously existing for sempiternal time and then assumed non-existent through having been corrupted. For it will follow that after it has been corrupted, it still possesses by reason of the matter a potency to something that cannot be reduced to act, namely, to existence in a previous time. If this is assumed possible, it will be true to say that it is now last year and that whatever existed in the past exists now, from the fact that a potency regards the present alone, as has been said.

p 1-119

The force of this argument consists in the fact that, since a potency looks only to the present or future, then if something is said to have a potency with respect to the past, it follows that the past is converted and made present or future.

p 1-119

286. Then at [†212] he proves his main proposition with an argument proper to natural science. And he says that also with a natural argument, and not a "universal" one, i.e., one that is logical or metaphysical, as the preceding were, it can be considered that it is impossible for that which always existed to be later destroyed, or for that which previously did not exist to be afterwards eternal. And this he proves because all destructible and generable things are alterable. For generation and destruction are the termini of alteration, and alteration passes from contrary to contrary. Consequently, it is plain that by the very contraries from which things come to be when previously they did not exist, such things are later destroyed and reduced back to the same by corruption. Thus, for example, if something from being hot is made cold, it can again be made hot by what is hot. And so it is plain that what has been generated, can again be destroyed; and that what was destroyed, was at one time generated.

287. It should be noted that these arguments of Aristotle are directed against the position that posits a world produced by generation and indestructible either of its very nature or through the will of God. But according to the Catholic faith, we hold that it began to be, not through a process of generation as from nature, but by flowing from a first principle whose power was not bound to give it existence in infinite time but as it willed, after previous non-existence, in order to manifest the excellence of its power over the totality of being, namely, that the totality of being depends entirely on it and its power is not confined or determined to the production of some given being. Now the things produced by it so as to exist forever have the potency and power to exist forever, and in no way at some time not to exist. For as long as they did not exist, they had no such power; but when they now exist, they have no power with respect to non-existence in the past but to the existence which now prevails or will be — for potency does not look to the past, but to the present or future, as the Philosopher says.

Thus it is clear that the preceding arguments in no way impugn the judgment of the Catholic faith. And with this the doctrine of the first book is brought to an end.

Lecture 1 (Aristotle's Text)

283b26-284b5

[213] That the heaven as a whole neither came into being nor admits of destruction, as some assert, but is one and eternal, with no end or beginning of its total duration, containing and embracing in itself the infinity of time, we may convince ourselves not only by the arguments already set forth but also by a consideration of the views of those who differ from us in providing for its generation. If our view is a possible one, and the manner of generation which they assert is impossible, this fact will have great weight in convincing us of the immortality and eternity of the world. [214] Hence it is well to persuade oneself of the truth of the ancient and truly traditional theories, that there is some immortal and divine thing which possesses movement, but movement such as has no limit and is rather itself the limit of all other movement. [215] A limit is a thing which contains; and this motion †1 being perfect, contains those imperfect motions which have a limit and a goal, having itself no beginning or end, but unceasing through the infinity of time, and of other movements, to some the cause of their beginning, to others offering the goal. [216] The ancients gave to the Gods the heaven or upper place, as being alone immortal; [217] and our present argument testifies that it is indestructible and ungenerated. Further, it is unaffected by any mortal discomfort, [218] and, in addition, effortless; for it needs no constraining necessity to keep it to its path, and prevent it from moving with some other movement more natural to itself. Such a constrained movement would necessarily involve effort—the more so, the more eternal it were—and would be inconsistent with perfection. [219] Hence we must not believe the old tale which says that the world needs some Atlas to keep it safe—a tale composed, it would seem, by men who, like later thinkers, conceived of all the upper bodies as earthy and endowed with weight, and therefore supported it in their fabulous way upon animate necessity. We must no more believe that [220] than follow Empedocles when he says that the world, by being whirled round, received a movement quick enough to overpower its own downward tendency, and thus has been kept from destruction all this time. [221] Nor, again, is it conceivable that it should persist eternally by the necessitation of a soul. †1 [222] For a soul could not live in such conditions painlessly or happily, since the movement involves constraint, being imposed on the first body, whose natural motion is different, and imposed continuously. †2 It must therefore be uneasy and devoid of all rational satisfaction; for it could not even, like the soul of mortal animals, take recreation in the bodily relaxation of sleep. An Ixion's lot must needs possess it, without end or respite. [223] If then, as we said, the view already stated of the first motion is a possible one, it is not only more appropriate so to conceive of its eternity, but also on this hypothesis alone are we able to advance a theory consistent with popular divinations of the divine nature. †3 But of this enough for the present.

Lecture 1 (Aquinas' Commentary)

p 2-1

ON THE HEAVENS

BOOK II

Lecture 1

The heaven is eternal and its motion endless and without labor. Contrary opinions excluded.

p 2-1

288. After having determined in Book I concerning the world as a whole, in which he showed to exist some bodies that are circularly moved and some that are moved with a straight motion, the Philosopher here begins to determine about the bodies that are circularly moved.

p 2-1

First he determines the question of the bodies themselves that are circularly moved;

Secondly, he determines the question of the center about which they are circularly moved (Lecture 20).

p 2-1

As to the first he does two things:

First he discusses the heaven, which is the circularly moved body;

Secondly, the stars which are in the heaven (L. 10).

p 2-1

About the first he does two things:

First he determines what pertains to the substance of the heaven; Secondly, what pertains to its motion (L. 7).

p 2-1

As to the first he does three things:

First he determines about the duration of the heaven;

Secondly, about the variety of its parts (L. 2);

Thirdly, about its shape (L. 5).

p 2-1

Regarding the first he does two things:

First he draws a conclusion made clear in what has gone before;

Secondly, from that conclusion he argues to his proposition, at 290.

p 2-1

289. He says therefore first [†213] that from what has gone before [LL. 22 ff. of Book I], we can believe that the entire heaven neither was made nor is able to be corrupted as some say.

p 2-1

He says that the whole heaven is ungenerated and indestructible on the ground that the major part of the bodies of the world is the substance of heavenly body, which is neither generated nor destructible, in the sense explained in Book I. Or else he is saying this to differentiate it from those parts of the world that are generable and destructible with respect to their parts, although not wholly, as is plain in the elements. Or else because those bodies which are generable and destructible, for example, plants and animals and stones, are not in the strict sense parts of the world (otherwise the world would never be perfect, since it would never possess all such things at once); rather they are effects of the parts of the world. Therefore, although such things are subject to generation and corruption not only with respect to a part but also as a whole, nevertheless the whole world is neither generated nor corrupted.

p 2-2

It should be noted that he says "the whole heaven was not generated," and then, instead of saying, "it is not corrupted," he says, "it cannot be corrupted." He uses this way of stating it for the sake of those who said that the world is of its very nature corruptible but that on account of God's will it never will be corrupted. He therefore specifically says, "as some say".

p 2-2

But it has been proved above that the world is one only and eternal (which he says lest anyone suppose that the eternal be not numerically one but one in species only), in such a way as to have neither a beginning nor an end "of the whole eternal," i.e., of its whole infinite duration.

p 2-2

Now, lest anyone suppose that he means the corporeal world is eternal as God is eternal, Whose existence and life are totally all at once, i.e., without any succession of before and after, he adds that the world "possesses an infinitude of time," since, namely, its duration extends according to the succession of time. Yet the whole world does not possess temporal duration in the same way as some generable and destructible singular, whose duration is comprehended by time but does not encompass time; rather time is encompassed by the whole world, both because time does not extend beyond the duration of the world and because time is produced from the motion of the first body of the world, as was explained in Physics IV. Thus time is contained by the world as an effect by its cause. Now time is the measure of a celestial motion not through the latter's being contained by it as an effect by its cause (for the container is not measured by the content, but the other way around), but through its being a certain image of God's eternity as Boethius says, "Who dost command time to proceed from the aeon."

p 2-2

Therefore the foregoing statements are worthy of belief not only on account of the arguments previously cited, but also on account of the contrary opinions of those who attribute generation and corruption to the world. For if the world turns out to be as we have described it, with no paradoxes arising, and it cannot have come about in the manner described by those who claim that the world was generated, then our description will have a "great inclination," i.e., great power to persuade one to believe in the immortality of the heaven and in its eternity — where "immortality" refers to the perpetuity of life and "eternity" to the perpetuity of its existence — for they maintained that the heaven not only existed but also lived, as something animated.

p 2-2

From what he says here, it is plain that Aristotle presented his previous arguments in proof of the eternity of the world not with the intention of showing with necessity that the world could not have begun but as showing that it did not begin in the manner described by others.

p 2-2

290. Then at [†214], from the preceding conclusion as to the eternity of the entire world, he concludes to his proposition, namely, to the eternity of the heavenly body. And concerning this he does three things:

First he infers the conclusion in a general way;

Secondly, he explains it in detail, at 292;

Thirdly, from the truth shown he excludes certain contrary opinions, 295.

p 2-3

About the first he does two things:

First he draws his intended conclusion;

Secondly, he presents its argument, at 291.

p 2-3

He says therefore first [†214] that, because we are inclined to believe in the eternity of the world from what has preceded, it follows that a man shows himself easily persuasable by the dictums of the ancients — not, however, by those of any who erred but principally by those of our fathers, who, namely, schooled us in divine worship. We should be inclined to believe their words to be true, to the effect that there is something immortal and divine, not only among the number of the immobile substances, which are totally separated from matter, but also among bodies which have motion, such, however, that of the motion of the divine and immortal body there be no end, by which, namely, it might be terminated; rather its motion is the end of all other motions. Now the reason he attributed this to the ancient sayings of the ancestors is because all those who established a form of divine worship among the gentiles sought to have divine worship given to the heaven as to a divine and immortal body whose motion is endless. Accordingly they derive from *thein,* which means "to run forever," their name for the deity, *theos*.

p 2-3

291. Then at [†215] he presents his argument for that part of the foregoing conclusion which stated that the motion of the heaven is the end of other motions. For everything that contains has the notion of end inasmuch as the contents end at the limits of the container. Now it is clear that the imperfect is disposed to be contained by the perfect. As was proved in Book I, circular motion is perfect and straight motions imperfect, for these do not return to their beginning as a circular motion does; rather their terminus is most remote from the beginning and contrary to it — wherefore, just as they begin to move at the start, so, they begin to rest when at the end. Consequently, circular motion must contain other motions as the perfect contains the imperfect. And for this reason circular motion is the end of other motions, in such a way, namely, that the former has neither a beginning nor an end at which to start or cease; rather, it moves without cease in infinite time. For whatever begins or ceases to be moved, does so under the influence of some previous motion, which is the cause of its motion. If the mover and moved were in the same relationship, there would be no more reason for a motion to begin later than before. Hence, if some motion begins newly, there must pre-exist some motion to cause the newness of this motion. Now if the world is eternal, motion would have to have always been. Hence it was necessary to posit some eternal motion which would contain other motions that were not eternal and be their end in such a way as to be a cause of motion in these mobiles which begin to be moved, and to receive the rest of those which cease to be moved.

p 2-3

He does not say "causes the state of rest" but "receives," because a universal cause aims at impressing its likeness on its effects which, however, cannot be equated to the universal cause but receive its likeness

according to their condition. Thus lower things do not uniformly receive from God the eternity of the divine being so as to remain forever the same in number, but they remain the same in species through the generation and corruption of individuals. Hence God gives existence to things but receives their corruption, using it, as it were, for the generation of other things. In like manner, the lower motions receive a likeness of the eternity of the heavenly motion not in a uniform manner but according to the alternation of motion and rest. Hence, whatever there is in them of motion is caused by the heavenly motion; but whatever is in them of defect of motion, i.e., of rest, is due to their defect, because it is not in their nature to be in eternal motion. So the motion of the heaven is said to accept the state of rest of these bodies as something ordained to an end. Wherefore Plato in the *Timaeus* has God, the establisher of the world, saying to the heavenly gods: "Make things increase by giving food and take back once more the things that suffered loss".

p 2-4

292. Then at [†216] he explains in detail what he had said:

First as to the eternity of the heaven;

Secondly, as to the quality of its motion, at 294.

p 2-4

That the heaven is eternal he shows in two ways. First from the sayings of the ancients. He says that they assigned to the gods the heaven and the place which is above, taking the heaven as immortal and suitable as a place for immortal beings, as was also stated above in Book I. And he gives to the place above the name "heaven" in keeping with the common opinion of those so speaking and also because the place whither light things are borne, and which is properly called an upward place, is nearest to the heavenly body.

p 2-4

293. Secondly, [†217] he explains it with a reason previously cited, which showed the heaven to be ungenerable and indestructible from the fact that it has no contrary. It was also shown there that the heaven is impassible, with the passion that produces difficulty of corruption. Heavenly bodies are, however, passible with a perfective passion, as in the case where the moon is illuminated and receives virtue from the sun. These things, too, were previously mentioned.

p 2-4

294. Then [†218] he shows the quality of the heaven's motion, namely, that it is moved without labor. This he proves on the ground that there can be posited no violent necessity that would keep it from being moved otherwise, i.e., according to its nature. For whatever is moved with labor is being moved against the natural motion of its body — for which reason it is laborious for an animal to move upwards. Now in the case of things moved against their nature, if such a motion is to continue, it must be maintained by some violent mover imposing on them a motion of coercion — for natural necessity leads only to what is according to nature. Everything such, i.e., which is subject to a motion contrary to its nature, must be in more and more labor accordingly as the motion is more continuous and eternal, and as it is more alien to its best disposition, i.e., that which is according to its nature. But such a thing cannot happen to the heavenly body, which is the noblest of bodies. Consequently the motion of the heaven is not laborious.

p 2-4

295. Then at [†219] he excludes contrary opinions.

First he dismisses certain errors;

Secondly, he concludes to the truth intended, at 299.

p 2-4

With respect to the first he dismisses three opinions, the first of which is a fable. And he says [†219] that because the motion of the heaven is neither laborious nor contrary to nature, no one should even slightly suspect that the eternity of the heaven and of its motion are as the ancient fables of Homer and other poets describe them. They said that the heaven, to be kept in its position, requires a giant they named Atlas, who stands upon two pillars and supports the world on his shoulders. Now the ones who originated that fable seem to have held the same opinion about celestial bodies as some later teachers, namely, that they were heavy and earthy, and as such had to be held up against their nature by animate power, or that of some living things, such as God or a separated substance of some kind. And if they maintain that this is necessary on the ground that the heaven has weight, the fable is wholly to be rejected. However, if they mean that the heaven has by nature such-and-such a position and motion, but that its nature was produced and is conserved by another, then the fable contains something divine.

p 2-5

296. Secondly, at [†220] he rejects the opinion of Empedocles who posited that the heaven is kept in its position that prevents it from falling by the rapidity of its motion which overcomes its natural inclination to fall — as occurs with water, which will not spill if the vessel of water is rotated more rapidly than the motion of the water downward. Democritus and Anaxagoras are also said to have held this.

p 2-5

Now this could perhaps happen for a short time, but that through such a speed of motion the heaven should keep its position for so great a time, namely, an infinite and perpetual time, is most unprovable. For since that which is violent is a certain exorbitation [departure] from what is according to nature, it does not seem that what is by violence could last longer than what is according to nature — since what is according to nature occurs, as it were, always, or for the most part. These latter, like the first, seem also to base their argument on the supposition that heavenly bodies have weight but are prevented from falling downward by the rapidity of their motion.

p 2-5

297. Thirdly, at [†221] he rejects a third opinion, that of Plato, who says in the *Timaeus* that in the center of the world, its soul, reaching to the extremity of the heaven and everywhere, began an imperishable and wise life for all time.

p 2-5

First he rejects this opinion on the part of the body. Hence he says that it is not reasonable to say that the heaven and its motion remain forever on account of the compulsion of the rational soul, because nothing forced can last forever, for, since compulsion is against nature, it would follow that what is according to nature would never exist.

p 2-5

298. Secondly, at [†222] he shows the same on the part of the soul. And he says that the life of the soul so moving a body cannot be without sadness and happy. For since the motion of the body is caused by compulsion and the soul moves that body circularly, which is inclined to be moved otherwise, and in addition moves this body continually, then of necessity that soul is never free and is removed from all "prudent strength."

p 2-5

Now "prudent strength" can refer to the operation of the speculative intellect, which requires prudence and strength, as though Aristotle were saying, "If the soul of heaven can in no way find relief from the labor it

strength, as though Aristotle were saying, "If the soul of heaven can in no way find relief from the labor it undergoes in moving the heaven against its nature, it will always be kept from vehement contemplation, which its uninterrupted labor and consequent sadness prevent."

p 2-5

Or "prudent strength" could refer to the effort the soul applies in order to keep things moving according to prudence. For it does not seem to be in keeping with prudence to apply its strength without ceasing to some task. For if laborious work is undertaken for a short time, it will be tolerable; but the heaven is moved with a continual and eternal motion. Hence if the soul of the heaven were to move the heaven against its nature in a laborious manner, it would follow that that soul would be worse off than the souls of mortal animals, which get rest from moving the body at least during sleep. But it is necessary that fate, i.e., the decree of some superior being keep the soul of the heaven eternal and indestructible, i.e., unfailing in moving, after the manner of a certain man called Ixion, who, the fables tell us, while acting as steward at Juno's wedding, lusted after her. But she substituted for herself a cloud, from which he begot the Centaur. For this he was condemned by Jupiter to be bound to a wheel on which he continually revolves.

p 2-6

This Aristotle seems to say against the statement of Plato who asserted that from the center of the world unto the outermost heaven the soul everywhere complex began an unceasing and prudent life for all time. For this would appear to be no different than being bound to the heaven as Ixion to the wheel. And it seems that the life of such a soul is not prudent but foolish, as undertaking an endless labor. However, Aristotle is not here reprehending Plato for positing an animate heaven — because later on he does the same — but for seeming to suppose that this soul is moving the heaven forever contrary to its nature. But perhaps Plato did not understand this motion as contrary to the nature of the heaven but wanted to bring out that the nature according to which this motion befits it is in it from another.

p 2-6

299. Then at [†223] he concludes from the foregoing that if our account of the first local motion, which is the heavenly motion, is correct, namely, that it is without labor, not only is to think this better from the point of view of the eternity of the heaven, but it is also more in conformity with our estimate of the gods — which he calls "divination," as though had by divine revelation. For that is the only way to keep our teaching consistent, since it does not appear congruent to say on the one hand that the heaven is being moved by God, and to say on the other that its motion is laborious. But this is enough on such matters for the present.

Lecture 2 (Aristotle's Text)

284b6-285a27

[224] Since there are some who say that there is a right and a left in the heaven, with those who are known as Pythagoreans—to whom indeed the view really belongs—we must consider whether, if we are to apply these principles to the body of the universe, we should follow their statement of the matter or find a better way. At the start we may say that, if right and left are applicable, there are prior principles which must first be applied. [225] These principles have been analysed in the discussion of the movements of animals, †1 for the reason that they are proper to animal nature. For in some animals we find all such distinctions of parts as this of right and left clearly present, and in others some; but in plants we find only above and below. [226] Now if we are to apply to the heaven such a distinction of parts, we must expect, as we have said, to find in it also that distinction which in animals is found first of them all. The distinctions are three, †2 namely, above and below, front and its opposite, right and left—all these three oppositions we expect to find in the perfect body—and each may be called a principle. [227] Above is the principle of length, right of breadth, front of depth. [228] Or again we may connect them with the various movements, taking principle to mean that part, in a thing capable of movement, from which movement first begins. Growth starts from above, locomotion from the right, sense-movement from in front (for front is simply the part to which the senses are directed). [229] Hence we must not look for above and below, right and left, front and back, in every kind of body, but only in those which, being animate, have a principle of movement within themselves. For in no inanimate thing do we observe a part from which movement originates. Some do not move at all, some move, but not indifferently in any direction; fire, for example, only upward, and earth only to the centre. [230] It is true that we speak of above and below, right and left, in these bodies relatively to ourselves. The reference may be to our own right hands, as with the diviner, or to some similarity to our own members, such as the parts of a statue possess; or we may take the contrary spatial order, calling right that which is to our left, and left that which is to our right. †3 We observe, however, in the things themselves none of these distinctions; indeed if they are turned round we proceed to speak of the opposite parts as right and left, above and below, front and back. [231] Hence it is remarkable that the Pythagoreans should have spoken of these two principles, right and left, only, to the exclusion of the other four, [231 bis] which have as good a title as they. [232] There is no less difference between above and below or front and back in animals generally than between right and left. The difference is sometimes only one of function, †1 sometimes also one of shape; [233] and while the distinction of above and below is characteristic of all animate things, whether plants or animals, that of right and left is not found in plants. [234] Further, inasmuch as length is prior to breadth, if above is the principle of length, right of breadth, and if the principle of that which is prior is itself prior, then above will be prior to right, or let us say, since 'prior' is ambiguous, prior in order of generation. †2 [235] If, in addition, above is the region from which movement originates, right the region in which it starts, front the region to which it is directed, then on this ground too above has a certain original character as compared with the other forms of position. On these two grounds, then, they may fairly be criticized, first, for omitting the more fundamental principles, [235 bis] and secondly, for thinking that the two they mentioned were attributable equally to everything.

Lecture 2 (Aquinas' Commentary)

Lecture 2

Diversity of parts of the heaven as to position. Opinion of Pythagoras

300. After settling the question of the perpetuity of the heavens, the Philosopher here determines the question of the variety of its parts.

First he determines the question of the diversity of parts considered from the viewpoint of their respective position in the same heaven;

Secondly, as considered from the relationship of the various heavenly bodies one to the other (L. 4).

As to the first he does two things:

First he determines concerning the diversity of the positional parts of the heaven according to the opinions of others;

Secondly, according to his own opinion (L. 3).

As to the first he does two things:

First he states his intention;

Secondly, he manifests his proposition, at 301.

He says therefore first [†224] that because some assert that one part of the heaven is on the right and another on the left, namely, the Pythagoreans, who put a right and a left in all things, it seems necessary to inquire whether things are as they assert or whether one should not rather attribute such things in a way different from theirs — if indeed it be necessary to apply these principles, i.e., right and left, to the body of the entire world by virtue of their being found in the heavenly body, which encompasses the whole world.

The reason why this matter should be considered is that it immediately occurs to a man that if there is a right and a left in the heaven, then there is even a greater reason and a prior one for thinking the prior principles are in the heaven, namely, up and down, before and behind.

301. Then at [†225] he manifests this proposition.

First he explains the condition of these principles as found in other things;

Secondly, that they are not found in all bodies, at 305.

p 2-7

As to the first he does two things:

First he shows that not all the aforesaid principles are found in all things;

Secondly, he explains in what order they are mutually related, at 303.

p 2-7

As to the first he does two things:

First he shows that all these principles are not found in everything, but in some things some only and not all;

Secondly, that it would be entirely unfitting that some, but not all, be attributed to the heaven, at 302.

p 2-8

He says therefore first [†225] that these principles, which are called differences of position, have been dealt with in the book *De Incessu Animalium*, since they are peculiar to such natures, namely, those of animals. For these differences of position are clearly found in animals according to definite parts. For some animals, namely, the perfect, which not only sense but move with local motion, possess all these parts, namely, right and left, before and behind, above and below; other animals, namely, the imperfect and stationary, possess some of them, namely, above and below, before and behind; while plants have only above and below.

p 2-8

302. Then at [†226] he shows that if any of them are assigned to the heaven, then all must be. And he explains that if we must assign any to the heaven, namely, either right or left, it is reasonable to suppose that that would be found which is found first in perfect animals; or it is reasonable that the heaven should possess that which is first in animals, because if we posit what is subsequent, we must posit what is prior. Now since there are three oppositions or "dimensions," each of them, namely, above, before and right is a certain principle of its opposite or dimension.

p 2-8

He subsequently expounds the three he has stated to be: one of these is the opposition or dimension between up and down, in which "up" is the principle; another is between before and its oppsite, which is called "behind," where what is before is the principle; yet another is between right and left, in which "right" is the principle. Now, since the perfect is that which is composed of all its parts or principles, it is reasonable that all these oppositions or dimensions should be found in "perfect bodies," i.e., in perfect animals. Hence, since the heaven is perfect above all, it is reasonable that if it be capable of any of these parts, it should have them all and not just some.

p 2-8

303. Then at [†227] he explains in two ways the order of the aforesaid principles. First, from the viewpoint of the dimensions themselves. For "up" is the principle of length: in man who is the most perfect animal, his length, as though his greatest dimension, is said from the head, which is his "up," to the feet, which are his "down." "Right" is the principle of width, for the width of a man is reckoned according to the distance between his right and his left. "Before" is the principle of depth: for the depth or thickness of a man is reckoned according to the distance between before and behind. The same holds respectively in other animals. But length is prior to width, and width to depth, just as line is to plane, and plane to body.

Therefore, "above" is prior to "right," and "right" is prior to "before."

p 2-8

304. Secondly, he proves the same thing [†228] from the viewpoint of motions. He does this because the things we have been discussing are certain principles from which motion first begins in animals that possess such parts or principles. For the motion of growth begins from above. This is evident in man, for the head, which is the "up" of man, is also up according to the position of the universe. Now the motion of growth begins from the head, because food is taken into the opening of the mouth, which is in the head, and food is the matter of growth. In plants, however, it is the root which is "up," and this is parallel to the head in animals, as far as the taking in of food is concerned. However, the "up" of a plant is opposite as to position to what is "up" for the universe. The other animals are midway between man and plants. Now motion with respect to place begins from the right, for animals move the right part before the left, as in walking they move the right foot. But in the motion by which the senses are altered, "before" is the principle, for that is said to be the forepart of the animal where the senses exist. Therefore, since the motion of growth is prior to the motion of sensation, which in turn is prior to local motion in animals, it follows that "above" is prior to "before," and "before" prior to "right."

p 2-9

305. Then at [†229] he shows that these principles are not present in all bodies.

First he concludes from the foregoing that, strictly speaking, these principles do not exist in non-living bodies;

Secondly, he explains how we come to speak of them as being therein, 306.

p 2-9

He says therefore first [†229] that since the foregoing are principles of certain motions, we should not look for above and below, right and left, before and behind, in all bodies, but only in animate bodies having a principle of motion in themselves. Now we do not find in any non-living body any originative source of motion.

p 2-9

This can be understood in two ways. First, in the sense that there is in living things an active principle of motion, namely, the soul, while in nonliving bodies there is no such active principle of motion which could move, but such things are moved by an external mover, which is the generator or that which removes what prevents motion. Yet they do have a passive principle of motion within, by which they are apt to be moved, for example, heaviness or lightness, as is plain in *Physics* VIII.

p 2-9

Or it can mean that in living bodies there is a definite part from which the motion begins, as has been said. But such a part is not found in non-living bodies. For, as he further says, some non-living bodies are not in motion at all, for example, those that already exist in their own place (or rather he says this with respect to artificial bodies which, as such, have no motion of themselves). Others are in motion, for example, the ones that are outside their own appropriate place, yet each such body is moved to its place in a similar way for each part. For example, fire is moved only upwards and earth only to the center of the world. In these cases no other difference of position is considered, either on the part of the body which is moved, so that one part would begin to be moved before another, or even on the part of the place, so that a natural thing would be moved to its own place from one position in space and not from another.

p 2-9

306. Then at [†230] he shows how these positions are sometimes said to exist in non-living bodies. And he says that in such bodies we speak of above and below, right and left, before and behind, only in comparison to ourselves. And this can take place in three ways. In one way, as we call that the right which is opposite to our right, as diviners, e.g., augurs, refer to a bird on our right, as the right bird and one on our left as the left bird. The second way is based on a likeness to our parts, as we call the right of a statue that which is similar to the right of man and the left that which is similar to our left. The third way is by a contrary position, as when we call the left what is opposite to our right, and what is opposite to our left we call right, as is plain in the case of an image in a mirror. The same explanations apply to the other positions.

p 2-10

But in non-living things considered in themselves, there is no such variation of parts. And this is evident from the fact that if we turn them toward us, the designations will be the opposite of what they were previously: what was right is now called left and vice-versa, and the same goes for the other positions. But in living things, no matter how they are turned about, these parts remain always the same.

p 2-10

307. Then at [†230] he shows that the Pythagoreans erred in attributing these differences to the heaven, and this in three ways, which can be gathered from the above reasoning. Consequently he adduces them here as conclusions. The first way is that, whereas there are six positions, one wonders why only two of them are attributed to the heaven, namely, the right and left, and the other four are ignored — although it is reasonable that all of them belong to the heaven, as was said above.

p 2-10

308. The second way is given at [†231], namely, that if any are to be omitted and not attributed to the heaven, it is the less principal ones which ought to have been omitted. But that the ones omitted are not less principal than the two attributed he proves with four arguments.

p 2-10

The first argument is given at [†232], namely, that in certain animals we do not observe that the difference between the part above and the part below, or between the part in front and the part to the rear, is less than the difference between the right side and the left side; rather, the difference is greater. For the right and left differ only in power but agree in figure (for the right hand is stronger than the left, although they are of the same shape; similarly, the right shoulder is stronger than the left as far as motions are concerned, although the left is stronger than the right for carrying a burden; in like manner, the right foot is better for motion, but the left is better for maintaining a fixed position). But it is plain that the front and rear of an animal, as well as the top and bottom, differ not only in power, but in shape as well. Now things that differ more appear to have a more principal distance.

p 2-10

309. The second argument is at [†233], namely, that top and bottom are found in all living bodies, whether animal or plant; but right and left are not in plants but only in perfect animals. Consequently, up and down are prior, where "prior" implies a non-convertible dependence in existence [on the part of the non-prior].

p 2-10

310. The third argument is at [†234], namely, that length is prior to width in the order of generation, for, according to geometers, a line in motion makes a surface. But "up" is a principle of length, and "right" a principle of width, as was explained above. Therefore, since the source of what is prior is itself prior, the consequence is that "up" is prior to "right," in the sense of something prior in the order of generation (for there are many ways in which things are said to be prior to others, as is plain in *Predica ments* and in *Metaphysics* V.

311. The fourth argument, at [†235] says that "up" is an originative source of motion, which may be understood of the motion of growth; "right" is the source of local motion; "before" is that toward which an animal moves, as though being opposite to its senses. From this it is clear that "up" has a certain chief role among all the types of position, just as the motion of growth is more essential and more intrinsic to an animal than is local motion.

Nevertheless, everything stated here may be better referred to local motion, by stating that "up," in an animal which moves according to local motion, is that whence motion proceeds, since it is in the head, namely, that sense functions and sense is the moving principle in animals, as stated in *De Anima* II. But "right" is that whence local motion begins, since the right part moves first, as was said, while "before" is that toward which the animal is moved. But the moving principle is that which has the primacy in the motion of an animal. In keeping with this it is evident that "up" has the primacy among the other types of position.

Thus does the Philosopher by means of these four arguments conclude his second way of disproving the assertion of the Pythagoreans. And he says it is just to rebuke them, since they ignored the more important principles and did not attribute them to the heaven.

312. He presents his third way at [†235], saying that they should be rebuked also for claiming that right and left are found similarly in all things, whereas in truth they are found only in perfect animals, as was said above.

But it should be kept in mind that it was the Pythagoreans' intent to reduce all things to good and evil as to two principles. And because they believed that all number is encompassed by 10, they posited ten things on the side of good and ten on the side of evil, as is plain in *Metaphysics* I. By each thing they placed in that enumeration they understood all the things to be found in its genus. Thus by "right" and "left" they understood all other positions, understanding that just as "right" is referred to good, so also "up" and "before," while "left," "down," and "behind" referred to evil. The reason why they posited right and left, rather than the other positions, was that the right is according to custom more obviously referred to the good and the left to evil — for we are accustomed to call good fortune "right" and evil "left" [i.e., "sinister"]. Consequently, they attributed right and left to all things to which they attributed good and evil.

Or perhaps they mentioned only right and left, as including the others in them, because they saw that whatever possessed a right and a left possessed all the others, but not vice-versa. Likewise they perchance especially applied to the heaven a right and a left and not the others, because there is in the heaven a local motion, to which right and left belong, but no growth, or sense alteration, to which up and down, before and behind belong respectively. Or perhaps it was because up and down, before and behind, are diversified with respect to shape, whereas right and left are not — for the parts of the heaven, being circular, are uniform in shape.

Lecture 3 (Aristotle's Text)

285a28-286a2

[236] Since we have already determined that functions of this kind belong to things which possess a principle of movement, †3 and that the heaven is animate and possesses a principle of movement, †4 clearly the heaven must also exhibit above and below, right and left. [237] We need not be troubled by the question, arising from the spherical shape of the world, how there can be a distinction of right and left within it, all parts being alike and all for ever in motion. [238] We must think of the world as of something in which right differs from left in shape as well as in other respects, which subsequently is included in a sphere. The difference of function will persist, but will appear not to by reason of the regularity of shape. [239] In the same fashion must we conceive of the beginning of its movement. For even if it never began to move, yet it must possess a principle from which it would have begun to move if it had begun, and from which it would begin again if it came to a stand. [240] Now by its length I mean the interval between its poles, one pole being above and the other below; [241] for two hemispheres are specially distinguished from all others by the immobility of the poles. †1[242] Further, by 'transverse' in the universe we commonly mean, not above and below, but a direction crossing the line of the poles, which, by implication, is length: for transverse motion is motion crossing motion up and down. [243] Of the poles, that which we see above us is the lower region, and that which we do not see is the upper. [244] For right in anything is, as we say, the region in which locomotion originates, and the rotation of the heaven originates in the region from which the stars rise. So this will be the right, and the region where they set the left. If then they begin from the right and move round to the right, the upper must be the unseen pole. For if it is the pole we see, the movement will be leftward, which we deny to be the fact. Clearly then the invisible pole is above. [245] And those who live in the other hemisphere are above and to the right, while we are below and to the left. This is just the opposite of the view of the Pythagoreans, who make us above and on the right side and those in the other hemisphere below and on the left side; the fact being the exact opposite. †1[246] Relatively, however, to the secondary revolution, I mean that of the planets, we are above and on the right and they are below and on the left. For the principle of their movement has the reverse position, since the movement itself is the contrary of the other: hence it follows that we are at its beginning and they at its end. [247] Here we may end our discussion of the distinctions of parts created by the three dimensions and of the consequent differences of position.

Lecture 3 (Aquinas' Commentary)

p 2-12

Lecture 3

How, according to the Philosopher's opinion, the differences of position befit the parts of the heaven

p 2-12

313. After determining the question of the positional parts of the heaven according to the opinions of others, the Philosopher here discusses them according to his own opinion. As to this he does three things:

First he shows that such positional differences must be in the heaven;

Secondly, he explains which dimension determines "up" and "down" in the heaven, at 320;

Thirdly, he shows which part of the heaven is up, and which is down, 323.

p 2-12

About the first he does two things:

First he proves his proposition;

Secondly, he excludes certain objections, at 317.

p 2-12

314. With respect to the first he gives the following argument [†236]: It has been previously determined that in things possessing a principle of motion, namely, in living bodies which possess a moving principle within themselves, there are found "such powers," i.e., differences of position according to the respective virtues in the parts, and not merely with respect to us, as in the case of non-living bodies which do not possess within themselves an active principle of motion but a passive one only, as is said in *Physics* VIII. But the heaven is animated and possesses a principle of motion.

p 2-12

That the heaven is animated he supposes from something proved in *Physics* VIII, namely, that all mobile beings must be reduced to one first self-mover that possesses its own active principle of motion and not merely its own passive principle, as some mentioned by Simplicius would claim. For they say that Aristotle called the heaven animate not because it had a rational soul but inasmuch as it had a kind of life implanted in its body in such a way, however, that the soul in it is nothing other than the nature of such a body. But that this is false is clearly shown by the words of Aristotle in *Metaphysics* XII to the effect that the first mover, which is completely immobile, moves the heaven as an object of thought and desire moves something. Consequently, it follows that, according to his opinion, the heaven is according to its soul something that desires and understands. And according to this, the motion of the heaven proceeds from its nature and from its soul: from its nature, indeed, as from a secondary and passive principle, inasmuch, namely, as such a body is apt to be moved in such a way; from its soul, however, as from a primary and active principle of motion.

p 2-12

315. Now in regard to this way of causing motion, it makes little difference whether the heaven is moved by a conjoined spiritual substance called its soul, or by a separated spiritual substance, except that a greater dignity accrues to the heaven if it is considered moved by a conjoined spiritual substance. This last consideration led Plato and Aristotle to posit an animated heaven.

p 2-12

Someone could object, however, that although it is more noble for a body to have a spiritual substance conjoined to it, yet for the spiritual substance it is nobler to be separated from a body. For this reason Plato was led to say that it is for the good of the rational soul to be separated from the body at some time. Now

according to this, since the mover is nobler than the moved and since motion depends more on the former, it seems better to say that the substance moving the heaven is separated from the body than to say that the heaven is animated; for this will give greater nobility to the motion of the heaven. Otherwise it would seem, following Plato's opinion, that the soul of the heaven would be in a worse condition than the human soul.

p 2-13

But an answer to this could be that in one sense it is nobler for the human soul to exist outside the body than in the body, namely, to the extent that it moves the body with labor against its nature. But in respect to the natural existence of the soul it is better for the soul to be in the body, because through it the soul attains the perfect existence of its species. Consequently, if there be a spiritual substance whose power is determined to the motion of the heaven, which it moves without labor, as was said above, then for that substance it is nobler to be in such a body than to be separated; because the action is more perfect which is performed through a conjoined instrument than with a separated instrument. But a separated substance whose power is not determined to this effect is absolutely nobler.

p 2-13

Now from the fact that the heaven is animated, he concludes, in keeping with what was said, that it possesses an "up" and "down" as well as "right" and "left."

p 2-13

316. But this seems inappropriate. For he said previously that up and down belong to an animated body on account of growth, but front and behind on account of sense, and right and left on account of local motion. But no one who posits an animated heaven assumes for it either a motion of growth or a motion of sensation. Therefore one should not posit an up and down in the heaven, or a front and behind.

p 2-13

But it must be said that in perfect animals having local motion, these differences are considered not only with respect to growth and sense but also with respect to local motion. For which reason he said previously in one of his arguments that "up" is the originative source of motion, "right" is the terminus "from which," and front is the terminus "to which." But in things that lack local motion and have no right and left, their up and down, front and behind, are based on other motions. Consequently all these dimensions ought to be attributed to the heaven solely on the ground of local motion, as to a thing which is most perfect.

p 2-13

317. Then at [†237] he excludes two objections, the first of which is this: The heaven is spherical in shape; consequently all its parts are similar. But the aforesaid differences of position require dissimilarity of parts either in respect to power alone, as in the case of right and left, or in respect to shape as well, as in the case of up and down, front and behind, as was said above. Therefore it does not seem that these differences of position can be attributed to the heaven.

p 2-13

The second objection is that in animals where these various kinds of position are found, one part is moved before the other. But this cannot occur in the heaven, for its parts are always being moved, as he says in *Physics* VIII. Hence it seems that such positions are not to be attributed to the heaven.

p 2-13

318. Then at [†238] he answers these objections, and first the first. He says that this argument should not cause us to doubt our conclusion, but one should rather understand the case with the heaven as though it had a difference between right and left even according to a difference of shape in the parts, but later one

had a difference between right and left even according to a difference of shape in the parts, but later one should put a sphere around it, not exteriorly as a garment but as a body joined to it naturally and covering it exteriorly. Then what would be thus would in reality possess one power on the right and a different one on the left, although it would not appear to be so differentiated, on account of the similarity of shape which would outwardly appear. In like manner, from the soul of the heaven there are different powers in its several parts, although they are alike in shape. It is on account of this variety of powers that the aforesaid positions are attributed to the heaven.

p 2-14

319. Then at [†239] he answers the second objection and says that doubt should not arise from the fact that animals, in which these differences exist, possess a principle [or starting-point] of their motion. For even though the heaven never begins to be moved, yet, because its motion is orderly, it is necessary to consider something in its motion as a starting-point whence its motion would begin if it did begin, or whence its motion would resume, if it should happen to stop.

p 2-14

320. Then at [†240] he explains which dimensions of the heaven are considered as up and down. First he proposes what he intends, and says that the length of the heaven is the distance between its poles, namely, the arctic and antarctic, in such a way that one of these poles is up, and the other down.

p 2-14

321. Secondly at [†241] he proves this proposition in two ways. First by reasoning. For it is plain that the length of any body is measured along its greatest dimension. Now the greatest dimension of a spherical body is diametric. But the diameter of the heaven is solely the one between the two poles, which are two immovable points of a sphere that never vary, whereas all other points taken are subject to motion. Consequently diameters drawn between any other two points are indeterminate. For this reason it is with respect to the line joining the two poles that the length of the heaven is considered, for inasmuch as these poles are not in motion, they allow us to see a definite difference of hemispheres.

p 2-14

322. Secondly, at [†242] he proves the same thing from the way people generally speak. For when we refer to the "sides" of the world, we do not mean the poles, which we call "up" and "down," but we mean something beside the poles, so that "east" is one side of the world, and "west" another, while the distance between the poles is the length of the heaven. For we call "side" what is adjoining "up" and "down" on either side, as is evident in man.

p 2-14

But it should be noted that for astronomers, who consider, not the dimensions of the heaven, but more the dimensions of the habitable earth, length is considered with respect to east and west, and width according to the distance from south to north — their reason being that the quantity of habitable earth from east to west is more than double that from pole to equator, since this is not fully inhabited.

p 2-14

323. Then at [†243] he shows which of the poles is up and which down.

First he shows this with respect to the first motion;

Secondly, with respect to the motion of the planets, at 329.

p 2-14

As to the first he does three things:

First he proposes what he intends;

Secondly, he proves what he has said, at 324;

Thirdly, he draws a conclusion from this, at 328.

p 2-15

He says therefore first [†243] that the pole which seems always to be over us is the downward part of the heaven, namely, the arctic pole; but the pole which is always hidden from us and called the antarctic is the part of the heaven referred to as up.

p 2-15

324. Then at [†244] he proves what he has said. Now it is manifest in the case of every animal that we call the "right" that which is the originative source of its local motion (on which account the right side of an animal is warmer, in order to be more apt for motion); but the circular motion of the heaven originates from that part whence the stars rise and which is called "east"; consequently the west will be its left. If, therefore, the motion of the heaven begins at the right and circulates back to the right, as though going from the same to the same, then necessarily the pole hidden from us, namely, the antarctic, is referred to as the upper part of the heavens, for if the arctic pole, which is never hidden from us, were the upper side, it would follow that the motion of the heaven would be from left to left. But this is not the way we speak of it.

p 2-15

This will be easier to understand if we imagine a man with his head in the arctic and his feet in the antarctic poles of the heaven. His right hand will be in the west and his left in the east, provided his face is toward the upper hemisphere, i.e., the one visible to us on earth. Therefore, since the motion of the heaven is from east to west, it will follow that it is from the left to the right. On the other hand, if we place his head in the antarctic and his feet in the arctic pole, with his face as before, his right hand will be in the east and his left in the west. Then the motion would begin from the right, as it should. Thus it is clear that the heaven's "up" is the pole which is hidden from us.

p 2-15

325. But there are three objections to this. First it is objected that Aristotle fails to determine what is "front" and what is "behind" in the heaven. But it should be answered that he passed over this as clear from what he has already determined. For an animal's motion, beginning from its right, proceeds forward and not backward. Hence, since the heaven is moved from east to west toward the upper hemisphere (which is evident from the fact that the stars seem to climb after they rise), the consequence is that "front" in the heaven is the upper hemisphere and "behind" the lower hemisphere.

p 2-15

326. In the second place it is objected that, although it is always the same part of the animal that is its right and another same part which is always its left, this does not seem to be observed in the heaven: for the same part of the heaven that was in the east comes to be in the west; consequently, if the east is the right side and the left the west, the same part of the heaven will be the right at one time and the left at another time.

p 2-15

But this is answered by something that Aristotle states in *Physics* VIII, namely, that the principle which moves the heaven is not moved *per accidens* as it is in animals. For these powers, according to which the

aforesaid positions are attributed to animals, depend on the motive principle. Hence in animals that exist here the "right" power is moved *per accidens* when the body of the animal is moved. But in the heaven that power is understood to be immovably rigid, even though the parts of the heavenly body are moved. Therefore the "right" of the heaven is always in the east, no matter which single part of the heaven happens to be there. And the same holds for the other powers.

p 2-16

327. In the third place it is objected that east and west seem not to be definite parts of the heaven but to vary according to the horizon in each region. Consequently, if right and left are attributed respectively to the regions of rising and setting, right and left will not be determinate in the heavens according to themselves, as they are in the bodies of animals, but only in relation to us, as is the case with inanimate bodies.

p 2-16

But it should be answered that, due to the immobility of the poles, up and down are said by him to be determinate in the heaven, while right and left are sides in relation to up and down. Therefore Aristotle is here taking rising and setting not in relation to our outlook but in relation to the immobile poles of the world.

p 2-16

328. Then at [†245] he concludes in the light of the foregoing to a difference as to the habitation of the earth. He says that since the hidden pole is up, those who live under that pole live in the upper hemisphere and on the right side of the heaven; but we who live on the other side of the earth are in the lower hemisphere and in the left side of the heaven. And this is contrary to the Pythagoreans, who held that we live in the upper direction and in the right side and the others in the downward direction and in the left side, while according to the foregoing the contrary happens.

p 2-16

Aristotle here seems to take "hemisphere" as that which results from dividing the heaven through the equinoxial circle [i.e., the equator] in a plane equidistant from the poles. From this it is plain that Aristotle is here saying that some men live or can live on the other side of the equator in a direction opposite to us. Now, if people are living or should live on the two quarters of earth that are distinguished from us by a circle intersecting the equator at right angles, passing through the equatorial poles, those people would be distinct from both of us, namely, who live above and below the equator, as people living on the rear of the heaven are distinct from the inhabitants of the fore part of the heaven, inasmuch as the motion of the heaven reaches them later, so that stars setting for us are rising for them and returning to the principle of motion, which is the right, when they are setting for them. But since the right and left are equally distant on the side from the up and down, it seems improper to say that we who live under the arctic pole inhabit the nether and left side, while the others inhabit the upper and right side.

p 2-16

To this it can be said that Aristotle spoke with respect to Greece in which he lived. Greece is indeed to the left inasmuch as it faces west and it is nether inasmuch as it is under the arctic pole. But since Aristotle seems here to speak in general for all the inhabitants in our habitat, it is better to say that he is speaking after the manner of Pythagoreans who referred right, up, and front, to the same thing, and the opposites to the same thing. According to this, Pythagoras considered that we live in the upper and right part. Or this could be according to perspective, because the arctic pole is directly above us, or better, looking to motions of the planets, as will be immediately evident.

p 2-16

329. Then at [†246] he shows how these positions are distinguished according to the motions of the planets. And he says that with respect to the second circular motion, namely, that of the planets, we conversely, are up and to the right, while the people on the other side of the earth are down and to the left. For the principle of planetary motion is contrary (for they begin to be moved from the west). The reason for this difference is that the two motions are "contrary," i.e., diverse, since contrariety, strictly speaking, is not found in a circular motion, as was explained in Book I. According to this, then, we live where the planet's motion begins and they live where it ends. Therefore those people seem to be stronger according to permanency, which is in the first motion; but we according to diversity of generation and corruption, which depend on the second motion, as will be explained later.

 p 2-17

Finally, at [†247] he summarizes and says that we have said this much about the parts of the heaven, which are determined according to the dimensions of the heaven and according to place, but not according to the material parts of the heaven, as was said above.

Lecture 4 (Aristotle's Text)

 286a3-286b9

[248] Since circular motion is not the contrary of the reverse circular motion, we must consider why there is more than one motion, [249] though we have to pursue our inquiries at a distance—a distance created not so much by our spatial position as by the fact that our senses enable us to perceive very few of the attributes of the heavenly bodies. But let not that deter us. The reason must be sought in the following facts. [250] Everything which has a function exists for its function. The activity of God is immortality, i.e. eternal life. †1 Therefore the movement of that which is divine must be eternal. But such is the heaven, viz. a divine body, and for that reason to it is given the circular body whose nature it is to move always in a circle. †2[251] Why, then, is not the whole body of the heaven of the same character as that part? Because there must be something at rest at the centre of the revolving body; and of that body no part can be at rest, either elsewhere or at the centre. It could do so only if the body's natural movement were towards the centre. But the circular movement is natural, since otherwise it could not be eternal: for nothing unnatural is eternal. †3 The unnatural is subsequent to the natural, being a derangement of the natural which occurs in the course of its generation. †4 Earth then has to exist; for it is earth which is at rest at the centre. (At present we may take this for granted: it shall be explained later. †5 [252] But if earth must exist, so must fire. [253] For, if one of a pair of contraries naturally exists, the other, if it is really contrary, exists also naturally. In some form it must be present, since the matter of contraries is the same. [254] Also, the positive is prior to its privation (warm, for instance, to cold), and rest and heaviness stand for the privation of lightness and movement. [255] But further, if fire and earth exist, the intermediate bodies †1 must exist also: for each element stands in a contrary relation to every other. (This, again, we will here take for granted and try later to explain. †2 [256] With these four elements generation clearly is involved, since none of them can be eternal: for contraries interact with one another and destroy one another. [257] Further, it is inconceivable that a movable body should be eternal, if its movement cannot be regarded as naturally eternal: and these bodies we know to possess movement. †3 Thus we see that generation is necessarily involved. [258] But if so, there must be at least one other circular motion: for a single movement of the whole heaven would necessitate an identical relation of the elements of bodies to one another. †4 This matter also shall be cleared up in what follows: [259] but for the present so much is clear, that the reason why there is more than one circular body is the necessity of generation, which follows on the presence of fire, which, with that of the other bodies, follows on that of earth; and earth is required because eternal movement in one body necessitates eternal rest in another.

Lecture 4 (Aquinas' Commentary)

 p 2-18
Lecture 4

The reason why there are in the heaven several spheres moved with a circular motion

p 2-18

330. After discussing the diversity of positional parts of the heaven, the Philosopher here settles the question of the diversity of parts based on the order of the spheres, and explains why there is not just one circularly-moved sphere in the heaven but several of them. Concerning this he does three things:

First he states the problem;

Secondly, he explains why this problem is difficult to solve, at 332;

Thirdly, he begins to solve it, at 333.

p 2-18

331. In regard to the first it should be kept in mind that if circular motions were contrary, it would not be difficult to see why there are many circular motions in the heaven and not just one. For since contraries differ specifically, inasmuch as contrariety is a difference with respect to form, as is said in *Metaphysics* X, the universe would not be perfect in its species if there were one contrary motion and not another, for example, if there were downward motion and not upward motion. Since, therefore, it has been previously proved that one circular motion is not contrary to another, we should inquire diligently as to the necessity of having many and diverse circular motions in the heaven. This question quite logically follows our previous discussion where it was said that up and down, and other such are assigned to the heaven in one way with respect to the first motion, and in another way with respect to the second.

p 2-18

332. Then at [†249] he points out the difficulty of solving this question. For that is difficult for men to consider when the question is "from afar," i.e., concerning the heavenly bodies far removed from us, since concerning things distant from us we cannot have a certain judgment. However, heavenly bodies are not only removed "by so much," i.e., according to the quantity of local distance, but much more by the fact that few of their accidents fall on our sense observation, whereas it is connatural for us to pass from the knowledge of "accidents," i.e., sensible things, to an understanding of a thing's nature. He states this distance to be much more than the local distance. For if we should consider the local distance, there is some proportion between the distance separating us from a heavenly body and that separating us from various lower bodies, e.g., a stone or some wood, and both distances are in one genus, but the accidents of heavenly bodies have a different notion and are wholly improportionate to the accidents of lower bodies. Yet, in spite of the difficulty, let us inquire into the "why" of the variety of heavenly motions. And the cause of this variety will be derived from what we are about to say.

p 2-18

333. Then at [†250] he assigns the cause of the aforesaid.

First he assigns it by the method of composition [synthesis], going from what is first to what is last in the order of inquiry;

Secondly, by that of resolution [analysis], proceeding from what is last sought to what is first, at 343.

p 2-18

With respect to the first [†250] he gives the following argument: If the heaven is a certain divine body, its motion must be eternal and circular; if its motion is eternal and circular, earth must exist; if earth exists, fire must exist; if fire and earth exist, there must be intermediate bodies; if such bodies exist, there must be generation; if there is generation there must be several motions in the heaven. Therefore, if the heaven is a perpetual and divine body, there must be a number of motions in the heaven, and consequently a number of

mobile bodies.

334. Then he explains each of these conditionals in order: and first of all the first one. With respect to this it must be remembered that the Platonists posited one supreme God Who is the very essence of goodness and unity, under Whom they put a superior order of separated intellects, which we are accustomed to call "intelligences"; under this order they placed the order of souls, and under this the order of bodies. They said, therefore, that among the separated intellects the first and superior ones are called "divine" intellects on account of their likeness and nearness to God; but the others are not divine, because of their distance from God. Similarly, among souls the supreme are intellective, while the lowest are not intellectual but irrational. The supreme and nobler bodies were said to be animate; the others inanimate. Furthermore, they said that the supreme souls, because they depend on the divine intelligences, were divine souls; and the supreme bodies, because united to divine souls, divine bodies.

Now, Aristotle uses this manner of speaking here. He says that anything which possesses its own operation exists for its operation, for everything seeks its perfection as its end; but operation is the ultimate perfection of a thing (or at least the product of the operation is, in the case of those things in which there is some product beyond the operation, as is said in *Ethics* I). For it is said in *On the Soul* II that form is first act, and operation second act as the perfection and end of the thing acting. And this is true both in material and in spiritual things (such as habits existing in the soul), and in natural as well as artificial things. And he adds the expression, "which produce a work" to take care of things contrary to nature, such as monstrosities, which produce no work as such, but suffer a defect in their operational power, as is plain in those born lame or blind. For lameness is not an end intended by nature, for the sake of which it makes an animal to be born lame; such a thing happens outside the intent of nature, by reason of a defect in the natural principles.

He adds further that "God's operation is immortality," where "God" refers not only to the first cause of all things but to all things called "divine" according to the custom of the Platonists and other gentiles.

But immortality appears not to be an operation but rather a difference or an impasibility. To this it must be answered that immortality designates unfailing life. Now life refers not only to the existence of the living being, but to its operation as well, as understanding is a certain living and as are sensing and other such, as is plain from *On the Soul* II and *Ethics* IX. This point is brought out when he says further that "this," namely, immortality, "is eternal life" — for which reason he does not say that God's operation is indestructibility, which refers only to the eternity of His existence but he says it is "immortality," in order to include eternity of action. Hence he concludes that if any mobile being is called "God" in this sense, its motion is eternal; just as, if some immobile substance is called "God," its operation is eternal without motion. If this were not so, then such a thing, eternal in existence but lacking an eternal operation (since things exist in order to act) would exist without a purpose.

Therefore, since the heaven is such as to have been called "God" by the ancients, not indeed because it is the supreme God, but because its body is something divine by virtue of being ungenerated and indestructible, as was previously explained; consequently it possesses a circular body in order that it may be moved forever and in a circular way. For it has been shown in *Physics* VIII that only circular motion can be eternal, since there is no motion over an infinite straight line, as was also proved in Book I, and motion over a finite straight line cannot be infinite except by reflexion, which involves interposing states of

rest, as was proved in *Physics* VIII.

p 2-20

It should be noted that Aristotle here proves the eternity of the motion of the heaven from the eternity of its body; but in *Physics* VIII he did not use this way, because he had not yet proved the eternity of the heaven. But because the heavenly body is related to the motion of the heaven as its matter and subject, whereas the first mover, namely, God, is the agent making it actually exist, then from the side of the heaven it can be proved able to be moved forever, but on the part of the divine will depends whether it is to be actually moved forever or not forever.

p 2-20

335. Then at [†251] he proves the second conditional, namely, that if the heaven is moved with an eternal and circular motion, earth must exist. He says, therefore: If it is true that the heaven is a divine body which is eternally and circularly moved, why then does not the entire heaven, i.e., the entire world, have such a body, i.e., why does not each part of the world have the nature of heavenly body? To this he answers that there has to be something permanent and at rest in the middle [center] of the body which is in circular motion — for it is plain that every circular motion goes around something at rest. And this something must be a body: for the thing I am calling the middle [center] is not something subsistent, but an accident of a bodily thing, if it is the center of a body. Now such a thing cannot be a part of this, i.e., of the heavenly body, which has already been described as divine, although it must be a part of the whole world.

p 2-20

This he proves in two ways. First, because no part of a heavenly body generally can be at rest everywhere, since to the heavenly body belongs eternal motion, as was shown. But the center about which there is circular motion must be stationary. Secondly, because taken specifically it cannot rest in the center. For if it rested there naturally, it would be naturally moved to the center (for each thing is naturally moved to the place in which it rests naturally, as was explained in Book I). But no part of the heavenly body is naturally moved to the center, because its natural motion is for it to be moved circularly, and, as was explained in Book I, no simple body can possess two natural motions. Hence it remains that the rest of a part of the heavenly body in the center would be against its nature.

p 2-20

From this it follows that the motion of the heaven could not be eternal: because it cannot take place unless there is something at rest in the center, and if the state of rest of that of it which was in the center were violent, it would follow that it [the rest] could not be eternal, and consequently neither could the heaven's motion be eternal. For nothing contrary to nature is eternal — since what is contrary to nature is subsequent to what is according to nature. This is plain from the fact that in the generation of anything, whatever is outside nature is a kind of "excess," i.e., a corruption and defect of that which is according to nature (for example, monstrosities are certain corruptions and defects of a natural thing). But corruptions and defect are naturally posterior, just as privation is subsequent to possession. Now it is not possible that something naturally prior should never exist, and that what is naturally apt to be later, should always exist. Consequently, it is plain that what is violent cannot be eternal. But that which is at rest in the center, is eternally at rest, just as the heaven is eternally in motion. What is left, therefore, is that there must be something naturally at rest in the center, if the motion of the heaven is circular and eternal. But it is the earth that is naturally at rest in the center, as will be proved later. Therefore, if the heaven is moved circularly and eternally, then earth must exist. And this is what was proposed to be proved.

p 2-21

336. Then at [†252] he proves the third conditional, namely, if there is earth, there is fire.

First he proposes what he intends, and says that it is also true that if earth must exist, then fire must exist.

First he proposes what he intends, and says that it is also true that if earth must exist, then fire must exist.

Secondly, he proves this with two arguments.

p 2-21

The first is this. If one contrary exists in nature, the other also must exist in nature. He proves this as follows: If there be any contrary, there must be a matter subject to it, as is plain from *Physics* I; but the matter of contraries is the same, as is shown in the same place. Consequently, the matter of one contrary must be in potency to the other. Now this potency would be in vain if that other contrary could not exist in nature. But since nothing is in vain in nature, then, if one contrary exists, so must the other. Now fire and earth are contraries, for they are the maximum distance apart, so far as contrariety of position is concerned, inasmuch as one is the heaviest of all things and the other the lightest (although in respect of other qualities, fire is especially contrary to water, as the hottest to the coldest — however, we are now speaking of bodies from the viewpoint of position, from which aspect they are parts of the whole universe). Consequently, if there is earth, there must also be fire.

p 2-21

337. The second argument is at [†254]. With respect to it, it should be considered that contraries are always related according to "worse" and "better," as is said in *Physics* I, in such a way, namely, that one of them is a privation and a defect in comparison to the other, as are, for example, cold in relation to hot, and black in relation to white. Now it is evident that "affirmation," i.e., whatever is said positively as something complete, is prior to what is described in terms of privation and defect, as hot is prior to cold. But rest and heaviness, which are attributed to earth, are stated in terms of the privation of lightness and of motion, which are attributed to fire. Therefore, fire is naturally prior to earth. For if the subsequent is posited, so must be the prior. Consequently, if earth exists, fire too must exist.

p 2-21

One should also note that Plato in the *Timaeus* proved that earth and fire exist on the ground that bodies have to be visible by virtue of fire and palpable by virtue of earth.

p 2-21

338. Then at [†255] he proves the fourth conditional, namely, that if fire and earth exist, so do the intermediate elements. For each of the elements is in some respect contrary to each of the other three, as earth is contrary to fire on the basis of heavy and light and cold and hot, and is contrary to air according to a contrariety of hot and cold as well as of wet and dry. And he says that this is to be made clear below, especially in *On Generation* II. Hence it remains that if two of the elements exist, the other two must also exist, it having been proved that if one contrary exists, the other must.

p 2-22

Plato, however, used proportional numbers to prove that if there are extreme elements there must be intermediate elements. For between two numbers that are cubes there must be two other numbers according to a continuous proportion: for example, the cube of 2 is 8 and the cube of 3 is 27 and between these cubes the numbers 18 and 12 fall as proportional means, so that all can be arranged to form a ratio of 3 to 2.

p 2-22

339. Then at [†256] he proves the fifth conditional, namely, that if such bodies exist, there must be generation and corruption. This he proves with two arguments. The first of these is that contraries act upon one another and are acted upon by one another, and corrupt each other, as will be proved in the book *On Generation*. But the aforesaid bodies are contrary to one another, as has been said. Therefore they mutually corrupt one another. Consequently, generation and corruption must exist.

p 2-22

340. The second argument is at [†257] and is as follows: It is unreasonable to assume that there exists an eternal body whose motion cannot be eternal, because motion is the operation of a mobile body and each thing is for the sake of its operation, as has been said. But the above-mentioned bodies, namely, the elements, have straight motions which cannot be eternal, as was proved in *Physics* VIII. Therefore they can not be eternal but have to be generable and corruptible. Consequently, it is necessary that generation and corruption exist.

p 2-22

341. Then at [†258] he proves the sixth conditional, namely, that, if there is generation, there has to be besides the first circular motion some other circular motion, either one or several. For since the first circular motion (which is that of the supreme sphere revolving the whole heaven from east to west) is uniform, it would not cause a diversity of dispositions in lower bodies. Consequently, the elements of bodies and other bodies would always retain the same disposition toward each other and there would be no generation and corruption. This will be explained more in detail later, namely, in *On Generation* II. Hence there must exist another motion, through the oblique [i.e., zodiacal] circle, to act as the proper cause of generation and corruption through the distance of the planets from us or their nearness to us, just as the first motion causes permanence and eternity in things.

p 2-22

342. Here Alexander asks if, supposing the motion of the heaven to cease, but the contrary elements to remain, they would corrupt one another? And, on the ground of their contrariety, he answers affirmatively; but not as though there would be reciprocal generation and corruption as now occurs when cold things are generated from hot and vice versa. What would happen would be what was posited by Heraclitus who said that at some time everything would become fire. For the present orderly mutual interplay of generation and corruption is traceable to the virtue of the heavens.

p 2-22

But it is better to say that if the motion of the heavens were to cease, so too would the motion of all lower bodies, as Simplicius said. For the powers of the lower bodies are as matter and instruments in relation to the heavenly powers, and hence do not move unless moved.

p 2-22

343. Then at [†259] he summarizes the same argument in the resolutary [i.e., analytic] order. And he says that the reason why there must be several circularly moved bodies is now plain, namely, because there must be generation. But generation must exist, if fire and other bodies exist; these must exist, if earth exists; earth must exist, because there has to be something eternally at rest in the center, if something undergoing circular motion exists.

Lecture 5 (Aristotle's Text)

286b10-286b11

[260] The shape of the heaven is of necessity spherical; for that is the shape most appropriate to its substance and also by nature primary.

286b12-286b31

[261] First, let us consider generally which shape is primary among planes and solids alike. [262] Every plane figure must be either rectilinear or curvilinear. Now the rectilinear is bounded by more than one line, the curvilinear by one only. But since in any kind the one is naturally prior to the many and the simple to the complex, the circle will be the first of plane figures. [263] Again, if by complete, as previously defined, †1 we mean a thing outside which no part of itself can be found, and if addition is always possible to the straight line but never to the circular, clearly the line which embraces the circle is complete. If then the complete is prior to the incomplete, it follows on this ground also that the circle is primary among figures. [264] And the sphere holds the same position among solids. For it alone is embraced by a single surface, while rectilinear solids have several. The sphere is among solids what the circle is among plane figures. [265] Further, those who divide bodies into planes and generate them out of planes †2 seem to bear witness to the truth of this. Alone †3 among solids they leave the sphere undivided, as not possessing more than one surface: for the division into surfaces is not just dividing a whole by cutting it into its parts, but division of another fashion into parts different in form. †4 It is clear, then, that the sphere is first of solid figures.

286b32-287a2

[266] If, again, one orders figures according to their numbers, it is most natural to arrange them in this way. The circle corresponds to the number one, the triangle, being the sum of two right angles, to the number two. But if one is assigned to the triangle, the circle will not be a figure at all.

287a3-287a11

[267] Now the first figure belongs to the first body, and the first body is that at the farthest circumference. It follows that the body which revolves with a circular movement must be spherical. [268] The same then will be true of the body continuous with it: for that which is continuous with the spherical is spherical. The same again holds of the bodies between these and the centre. Bodies which are bounded by the spherical and in contact with it must be, as wholes, spherical; and the bodies below the sphere of the planets are contiguous with the sphere above them. The sphere then will be spherical throughout; for every body within it is contiguous and continuous with spheres.

Lecture 5 (Aquinas' Commentary)

Lecture 5

Spherical shape of the heaven shown from fact that it is the first of figures

344. Having discussed the eternity of the heaven and the diversity of its parts, the Philosopher here determines the question of the figure of the heaven.

First he shows that the heaven is spherical in shape;

Secondly, that this shape exists in it perfectly (L. 6).

Concerning the first he does two things:

First he proves with arguments based on the heaven itself that it is spherical in shape;

Secondly, with an argument based on the lower bodies (L. 6).

About the first he does two things:

First he proposes what he intends [†260] and says that the heaven has to be spherical in shape both because such a shape is most "proper," i.e., appropriate, to the heavenly body, and because it is the first of all figures not only "by nature," as the perfect is naturally prior to the imperfect, but "by substance," i.e., according to its notion, as one is prior to many.

Secondly, he proves his proposition.

First he shows that the heaven is spherical in shape because this figure is the first of figures;

Secondly, because it is most appropriate to the heaven (L. 6).

Regarding the first he does two things:

First he shows that the supreme heaven has a spherical shape;

Secondly, that the other heavenly bodies also are spherical in shape, at 352.

345. With respect to the first he gives the following argument: The first figure should belong to the first body. But among bodily figures, the spherical is first. Therefore the heaven which is the first body is spherical in shape.

In regard to this argument he first proves the minor premiss; Secondly, the major having been laid down, he draws the conclusion, at 351.

p 2-23

As to the first he does two things:

First he proves with arguments that the spherical shape is the first of all bodily shapes;

Secondly, by appealing to the opinions of others, at 349.

p 2-23

Regarding the first he does two things:

First he proposes what he intends [†261] and says that we must determine universally which is the first of all figures both in the realm of plane figures, i.e., surfaces, and in the realm of solid, i.e., bodily, figures. A plane figure is the shape of a plane and a bodily figure is the shape of a body.

Secondly, he proves his proposition.

First with respect to plane figures;

Secondly, with respect to bodily figures, at 348.

p 2-24

346. With respect to the first he gives two arguments, the first of which [†262] is this: Every plane figure is either rectilinear, as in the case of a triangle or square, or it is curved, as in the case of a circle. But every rectilinear figure is enclosed by a plurality of lines and not by just one (for a single straight line can be extended only in one direction, whereas the nature of a plane figure is that it be entirely closed in every direction). On the other hand, a circular figure is enclosed by but one single line extended in all directions. Now, in every genus, unity is prior to multiplicity, and simplicity to composition. Hence it remains that in the realm of plane figures, the circular is first.

p 2-24

347. The second argument is given at [†263], namely, that the perfect is by definition that outside of which there exists nothing that could befit it; for example, a man is said to be perfect, if he lacks nothing that pertains to man. And this has been settled previously both in *Physics* III and in the beginning of this book. Now, we observe that, so far as the nature of a straight line is concerned, addition can always be made to it — although for some other reason it might be impossible to do so, as, for example, to add anything to the diameter of the world. And this is plain if the straight line is finite. Accordingly, every finite straight line is imperfect. But it is plain that an infinite line, too, is imperfect, for it lacks an end, which it should have. On the other hand, no addition can be made to a circular line, because its end meets its beginning. Consequently, the line encompassing a circular body is perfect.

p 2-24

Now the perfect is prior to the imperfect, absolutely speaking, both by nature and in point of time. But in one and the same thing, the perfect is prior by nature but the imperfect is prior in point of time — for example, a man in point of time is a boy prior to being a perfect man; yet the perfect man is prior by nature, because this is what nature intends. Absolutely speaking, even in point of time the perfect is prior to the imperfect, because a boy is generated by some man. From this it is plain that the circle, too, is the first among plane figures.

p 2-24

348. Then at [†264] he shows which is the first shape among bodily figures. And he says that in like

348. Then at [†264] he shows which is the first shape among bodily figures. And he says that in like manner the sphere is the first among solid, i.e., bodily, figures, since the spherical figure alone is bounded by just one surface which everywhere surrounds the spherical body. Rectilinear bodily figures, on the other hand, are bounded by several planes — as a cubic body by six, and a triangular pyramid by four. Therefore, as the circle is to planes, so the sphere is to solids, i.e., bodies.

p 2-24

349. Then at [†265] he shows his proposition by appealing to the opinions of others. And he gives two such opinions. The first is held by those who resolve bodies into surfaces, and produce bodies from surfaces. For the only body that does not resolve into a number of surfaces is the sphere, because it is bounded by just one surface, while other figures are resolved into many surfaces, as, for example, a pyramid is into four triangular surfaces. However, such a division of bodies into surfaces is not according to the manner by which a body is divided into its bodily parts; for a sphere also is thus divided into its parts. But the division under discussion is one that, so to speak, separates into things that are different in kind from the whole that is divided. He concludes, therefore, that it is clear that the sphere is the first among solid figures.

p 2-25

350. The second opinion is given at [†266]. And he says that some have assigned the order of figures according to the species of numbers, by adapting the figures to numbers. And he says that, according to this, it is most reasonable for the circle to be adapted to unity, on the ground that it is the first and simplest of shapes; but that triangle be adapted to 2, because its angles equal two right angles. Now, if unity were aligned with triangle, it would follow that the circle, which is naturally prior to the triangle, would be outside the genus of figures, supposing triangle to be the first of shapes.

p 2-25

351. Then at [†267], having proved the minor premiss, he syllogises to his proposition. And he says that, since the first figure is due to the first body, and the first body is that which is on the outer periphery of the whole world, it follows that such a body, which is moved circularly, will in itself be spherical.

p 2-25

352. Then at [†268] he shows that even the lower heavenly bodies are spherical. And he says that from the fact that the first body is spherical, it follows that the next body "continuous" to it, i.e., immediately joined to it, is spherical: for that body which is "continuous" to, i.e., immediately joined to, the spherical body, must itself be spherical. Now this is true if the first body is spherical not only on its convex, but also on its concave, side. Since the very same nature of first body is in both these sides, it must have the same figure on both sides.

p 2-25

The same argument holds for the other bodies which are in the center of these and contained by them, namely, they too have to be spherical. For those bodies that are contained and touched by the body that is spherical according to its convex side must also be spherical on their convex side, and consequently spherical according to their concave side, if they are of one nature. Since, therefore, the spheres of the lower planets touch the higher sphere, it follows that the whole of "what is carried," i.e., the whole body which is circularly moved, has a spherical shape, for all those bodies of the heavenly spheres mutually touch and are "continuous," i.e., in immediate contact one with the other. And there is no intermediate body that fills up voids between spheres, as some say — for it would follow that those bodies would be idle, since they would not have a circular motion.

Lecture 6 (Aristotle's Text)

287a12-287a22

[269] Again, since the whole revolves, palpably and by assumption, in a circle, and since it has been shown that outside the farthest circumference there is neither void nor place, from these grounds also it will follow necessarily that the heaven is spherical. For if it is to be rectilinear in shape, it will follow that there is place and body and void without it. For a rectilinear figure as it revolves never continues in the same room, but where formerly was body, is now none, and where now is none, body will be in a moment because of the projection at the corners. Similarly, if the world had some other figure with unequal radii, if, for instance, it were lentiform, or oviform, in every case we should have to admit space and void outside the moving body, because the whole body would not always occupy the same room. †1

287a23-287a29

[270] Again, if the motion of the heaven is the measure of all movements whatever in virtue of being alone continuous and regular and eternal, and if, in each kind, the measure is the minimum, and the minimum movement is the swiftest, then, clearly, the movement of the heaven must be the swiftest of all movements. Now of lines which return upon themselves †2 the line which bounds the circle is the shortest; and that movement is the swiftest which follows the shortest line. †1 Therefore, if the heaven moves in a circle and moves more swiftly than anything else, it must necessarily be spherical.

287a30-287b14

[271] Corroborative evidence may be drawn from the bodies whose position is about the centre. If earth is enclosed by water, water by air, air by fire, and these similarly by the upper bodies—which while not continuous are yet contiguous with them †2-and if the surface of water is spherical, and that which is continuous with or embraces the spherical must itself be spherical, then on these grounds also it is clear that the heavens are spherical. [272] But the surface of water is seen to be spherical if we take as our starting-point the fact that water naturally tends to collect in a hollow place—'hollow' meaning 'nearer the centre'. Draw from the centre the lines *AB, AC,* and let their extremities be joined by the straight line *BC.* The line *AD,* drawn to the base of the triangle, will be shorter than either of the radii. †3 Therefore the place in which it terminates will be a hollow place. The water then will collect there until equality is established, that is until the line *AE* is equal to the two radii. Thus water forces its way to the ends of the radii, and there only will it rest: but the line which connects the extremities of the radii is circular: therefore the surface of the water *BEC* is spherical.

287b15-287b21

[273] It is plain from the foregoing that the universe is spherical. It is plain, further, that it is turned (so to speak) with a finish which no manufactured thing nor anything else within the range of our observation can even approach. For the matter of which these are composed does not admit of anything like the same regularity and finish as the substance of the enveloping body; since with each step away from earth the matter manifestly becomes finer in the same proportion as water is finer than earth.

Lecture 6 (Aquinas' Commentary)

p 2-26

Lecture 6

The heavens must be spherical, because this shape is most fitting

p 2-26

353. After showing that the heaven has a spherical shape on the ground that such a shape is the first of all figures, the Philosopher shows the same thing on the ground that this shape is most suitable to the heaven.

p 2-26

First from the fact that it is suitable to the heaven on account of its being the universal container of all bodies;

Secondly, on account of its motion being the universal measure of all motions, at 356.

p 2-26

354. With respect to the first [†269] he puts forward two suppositions previously made clear. The first is that the heaven is moved circularly — which is both evident to sense and is supposed from the proofs in Book I. The second supposition is taken from what was proved in Book I, in the chapter on the unity of the world, namely, that beyond the final circulation of the outermost sphere there is neither place nor void.

p 2-26

From these suppositions he necessarily concludes that the body of the heaven is spherical. For if it were not it would have to be either entirely rectilinear, or only partially circular without being a perfect sphere. But if the body of the heaven should be truly rectilinear — for example, a cube or a pyramid — it follows that beyond the heaven there would exist a place and a body and a void.

p 2-26

That this consequence follows he shows on the ground that a rectilinear body in circular motion will not remain in the same place with respect to all its parts. As a matter of fact it will follow that where one part of it first was, no part of it now is; and again where no part of it now is, a part of it will later be. This is true on account of the interchange of corners. For in any body rectilinear in shape there must be certain bodily corners which extend beyond the other parts of the body, since a line drawn from the center of such a body [to a corner] is greater than a line drawn to some point on the plane surface of the body. Accordingly as the body turns, the line ending at the corner will reach the place previously occupied by the line drawn to a point between the corners and will occupy more space, and thus there will be a body where one was not before. The subsequent line [i.e., the line to the plane surface], arriving at the place formerly occupied by the corner will not be able to occupy the whole place formerly occupied by the corner, so that where there is now no body, there previously was body. Thus, therefore, outside the place in which the heaven now is, there can be existing a body, i.e., some part of the same heaven. Consequently there is a place there, i.e., the receptacle of a body. Likewise there is a void, which is nothing more than a place not filled with the body of which it is capable.

355. But because there are certain figures that have no angles and yet are not spheres, he subsequently shows the same thing for these figures. And he says that a similar impossibility follows if we should attribute to the heaven some other shape, such that not all the lines from its center would be equal, as is proper to a sphere. And he says that there are two such figures, namely, lentil-shaped and oval-shaped. Now in an oval figure the line designating the length is greater than that designating the depth; indeed, an oval figure can be conceived as the result of two round pyramids joined at their bases. But the shape of a lentil is as though made in the fashion of a wheel whose width is greater than its thickness. Now in all such figures, it comes about in some way that beyond the ultimate motion of the outermost sphere a place and a void will exist, because of the fact that the whole is not always retaining the same place according to all its parts. This happens if one takes the poles about which the oval-shaped body is revolved on the part of its lesser diameter; for then the greater diameters must describe a circular motion and consequently one head of the moved oval will occupy a place in which previously no part of it was. But if, however, the length of the oval should be taken in its motion as the fixed axis, the revolutions would always take place according to circular parts, so that one part would succeed another. The same thing is also to be imagined with respect to the lentil-shaped figure; and likewise for a cylindrical figure and for any other such figure.

Hence it is plain that only a spherical shape is such that, no matter how it be moved, no part will occupy some new place [not previously occupied by some other part]; rather one part of it always succeeds another part of it. Hence such a shape is most suitable to the heaven.

356. Then at [†270] he proves the same with another argument, based on the measurement of motions. First he lays down the supposition that the motion of the heaven is the measure of all motions, as was maintained in *Physics* IV. And he gives the reason for this, namely, that only the motion of the heaven is continuous and regular and eternal; for in no other way could the quantity of other motions be certified through the motion of the heaven — and this is to measure them. For if the motion of the heaven were not continuous, but interrupted, there would not be equality of time between the measuring motion and the measured motion. If the motion were not regular, but now faster and now slower, it would not have within itself a determined certitude by which the quantity of other motions could be certified. If it were not eternal, there could not be measured through it motions that existed before and which will exist later, following the opinion of those who hold motion to be eternal by nature.

With these suppositions in mind, he argues to his point in the following manner: It is plain that whatever is the least in each genus is the measure of that genus, as is had in *Metaphysics* X, as a tone in melody, and the ounce among weights, and unity among numbers. It is also plain that the least motion is the one which is most rapid, i.e., the one having the least time, which is the measure of motion. Therefore the swiftest of all motions is the motion of the heaven. Here the swiftest of motions means the one which goes through its course sooner as to shortness of time, although there is not supposed equality on the part of the magnitude traversed by the motion, as is supposed in *Physics* IV, where it is stated that the swifter is that which in a lesser time traverses an equal, or even greater, distance. That is why he now adds here that the swiftest motion is considered with respect to the least magnitude. Now among all lines that return to their beginning the circle is the smallest — since in rectilinear figures there are angles such that lines drawn to them from the center are greater and consequently the corners of such figures jut out farther than a circular line. Accordingly, the motion of the heaven, which moves circularly, as though from the same to the same, and with the swiftest motion, traverses a circle in its motion. Therefore the heaven must be spherical.

357. Then at [†271] he shows that the heaven has a spherical shape by using an argument taken from the lower bodies.

First he presents his argument;

Secondly, he proves what he had supposed, at 359.

p 2-28

He says therefore first [†271] that someone can come to hold that the heaven is spherical by considering the lower bodies that are located about the center of the heaven. For water is about the earth, although it does not entirely cover the earth (because of the need for the generation and preservation of life, specially that of animals and plants) and air surrounds the water, and fire surrounds the air. And according to the same procedure the upper bodies surround the lower bodies up to the outermost heaven. Now such bodies are not continuous as though forming one body, for then each of them would not be spherical in shape but rather the whole (for a part of a continuous body is not shaped in act). But these bodies touch one another without any other body existing between them, and without any empty space between them as Democritus laid down. Now, the surface of one of these lower bodies being spherical, consequently the body "continuous" to it, i.e., conjoined without interpolation to the spherical containing [contained?] body, or which moves around the spherical contained body, must be spherical. Hence beginning with the lower body, it can be proved, by ascending to the outermost heaven, that the heaven is spherical.

p 2-28

358. But it seems that this proof lacks necessity. For if it is assumed that water has a spherical shape, it will clearly follow that air on the concave side will be spherical, but this does not necessarily seem to follow for its convex side.

p 2-28

To this Alexander responds that from this demonstration it is proved that the bodies of the world are spherical as to their concave side, just as from the previous argument, which proceeded from the outermost heaven proceeding downward, it was proved that these bodies are spherical on their convex side. Hence according to this, neither of these arguments is complete without the other, but from the two arguments one demonstration results.

p 2-28

But this seems to be contrary to Aristotle's intention, who presents each as a separate argument, as though each was complete in itself. And therefore it should be said, as Simplicius asserts, that this demonstration sufficiently proves that the bodies of the world are spherical both with respect to their concave and their convex. For since the convex surface of water is spherical, it is plain that the concave side of air is spherical. That the convex side of air is spherical is plain in the same way that it is plain for the water, namely, because all its parts equally concur to the same place. Accordingly it is also plain that the concave side of fire is also spherical. But that the convex surface of fire is spherical can be plain both from the fact that it is continuous with the sphere of the moon (for which reason it revolves together with it, as is clearly plain from the movement of a comet which moves from east to west in accordance with the motion of the heaven), as well as from the fact that the parts of fire are from all directions moved equally to their proper place.

p 2-28

359. Then at [†272] he proves what he had supposed, namely, that the convex side of water is spherical; for later on he will prove it for earth. In order to show this, he premises two suppositions. The first of these is that, since water is naturally heavy, it always naturally flows to a place that is more concave, or

lower. The other supposition is that a thing is more concave and lower according as it is nearer to the center of the world.

p 2-29

On these suppositions let A be the center of the world, and B and G two designated points on the surface of the water that are equidistant from the center, and let there be drawn two lines AB and AG. Join the two points B and G so as to form the line BG, which will be a straight line, if the water's surface is flat. Let there be marked a point D in the line BG, which is the base of a triangle, and draw the line AD from the center. This line must be less than either of the other two lines AB and AG drawn from the center. For if it were equal, then all three lines proceeding from the same point would be equal, and thus the line BDG, passing through their extremities, would be circular, as is plain from *Euclid* III. But this would be against our assumption that the line BG is a straight line. Therefore, supposing that the line AD is shorter than the others, it will follow that the point D will be less distant from the center, and consequently its place will be deeper or lower. Hence, it will follow according to the foregoing supposition that the water in point G and in point B will flow to point D until the middle place is equated with the other two extremes. Let AE be the whole line equated to the two extremes from the meeting of the waters. Therefore the water must be along all the equal lines coming from the center; for water rests only when all the lines are equal. But the line which touches three equal lines proceeding from the center is circular, as is proved in *Euclid* III. It follows therefore that the surface of the water, on which the line BEG is described, is a spherical surface — and this is what he intended to demonstrate.

p 2-29

360. Then at [†273] he concludes from the foregoing that the world is manifestly spherical both on account of the first body which contains the entire world and also on account of the other bodies contained by it. But among us there are spherical bodies which nevertheless do not have a perfectly spherical shape; for example, the very body of the earth is said to be spherical, even though it has the great elevations of mountains and the depressions of valleys. Likewise, in our artificial bodies that are spherical, we find bumps and depressions, in spite of which such artifacts are said to be spherical in shape, since such additions or subtractions are reckoned as though nothing according to sense.

p 2-29

Therefore lest anyone believe that the same thing happens in the heavenly body, Aristotle adds that it is "turned with diligence," i.e., lacks all bumps and hollows, as do bodies carefully turned on a lathe, so much so that nothing *chirocmeton*, i.e., made by hand, is comparable to a heavenly body in this respect, nor any other natural body that our eyes behold. For the things from which such bodies are constituted cannot obtain, through the action of art or lower nature, that regularity, i.e., uniformity, and diligence for perfect spherical shape which a heavenly body possesses in virtue of its natural spherical shape.

p 2-29

This he proves through the proportion of the parts of the world to one another. For it is plain that according to the same proportion by which water exceeds earth, the containing elements always exceed the bodies contained — or even in greater proportion. But water, which contains the earth, does not have the swellings and depressions on its surface that earth has; rather its surface is more regular than the earth's surface. Similarly, the air's surface must be more regular than water's. Hence it follows that the surface of the outermost heavenly body is supremely regular, so that in it there is not even the slightest addition or subtraction.

Lecture 7 (Aristotle's Text)

[274] Now there are two ways of moving along a circle, from *A* to *B* or from *A* to *C*, †1 and we have already explained †2 that these movements are not contrary to one another. [275] But nothing which concerns the eternal can be a matter of chance or spontaneity, and the heaven and its circular motion are eternal. We must therefore ask why this motion takes one direction and not the other. [276] Either this is itself an ultimate fact or there is an ultimate fact behind it. [277] It may seem evidence of excessive folly or excessive zeal to try to provide an explanation of some things, or of everything, admitting no exception. The criticism, however, is not always just: one should first consider what reason there is for speaking, and also what kind of certainty is looked for, whether human merely or of a more cogent kind. †3 When any one shall succeed in finding proofs of greater precision, gratitude will be due to him for the discovery, [278] but at present we must be content with a probable solution. †4 If nature always follows the best course possible, and, just as upward movement is the superior form of rectilinear movement, since the upper region is more divine than the lower, so forward movement is superior to backward, then front and back exhibits, like right and left, as we said before †5 and as the difficulty just stated itself suggests, the distinction of prior and posterior, which provides a reason and so solves our difficulty. Supposing that nature is ordered in the best way possible, this may stand as the reason of the fact mentioned. For it is best to move with a movement simple and unceasing, and, further, in the superior of two possible directions.

Lecture 7 (Aquinas' Commentary)

p 2-30
Lecture 7

Why the circular motion of the heaven is in one direction rather than another
p 2-30
361. After determining as to the parts of the heaven and its shape, the Philosopher here decides the question of its motion.

p 2-30
First he discusses the manner of its motion; Secondly, the uniformity of its motion (L. 8).

p 2-30
Regarding the first he does three things:

First he raises the question;

First he raises the question;

Secondly, he shows the difficulty of the question, at 364;

Thirdly, he proposes a solution, at 365.

p 2-30

About the first he does three things:

First he mentions certain things that give rise to the question. One of these is that there are two ways in which a thing could be moved through a circle. For if we let A be a point on a circle and draw a diameter from A, and let B be a point on the upper semicircle, and G a point on the lower, there will then be two possible ways for something to move over this circle: in one way, something could go from A to B; in another, from A to G. Another thing he mentions is that those two motions are not contrary, for it has been shown in Book I that two circular motions are not contrary. For if they were contrary, they would have to belong to the natures of contrary mobile things, so that one motion would be attributed to one mobile and the other to the contrary mobile — because, as has been said, if one of two contraries exists in nature, so must the other.

p 2-30

362. Secondly, at [†275] he raises the question. For it is plain from the foregoing that in things that are eternal nothing happens contingently or fortuitously, because happenings due to chance do not occur always or even nearly always. But it has been said above that the heaven is eternal and also its circular motion. Hence it is reasonable to ask why it is that the heaven is moved in one direction rather than in the other; for example, from the east in the direction of the upper hemisphere and not of the lower.

p 2-30

363. Thirdly, at [†276] he shows how such a cause must be assigned. For in the previous accounts he assigned a cause of celestial events in two ways. First, he showed that there have to be various motions in the heaven in order that generation and corruption be possible; secondly, he showed that the figure of the heaven has to be round by assuming a prior principle, namely, that the first shape is appropriate to the first body. Thus the primacy of the body is the reason why it has the first shape. And therefore he says here that if we must assign the reason why the heaven is moved as it is and not in some other way, that reason must be assigned either on the ground that such a type of motion is the principle of some effect, or rather that this type of motion depends on some prior principle.

p 2-30

This can also be understood in another way. For he had said that eternal things cannot be due to chance. Yet not all eternal things have a cause, for there is an eternal thing which has no cause but is itself the first cause of other things. Since, therefore, on the grounds of the eternity of the heaven and of its motion, he had arrived at the question concerning the cause why the motion of the heaven is in one direction rather than another, lest the question appear foolish or useless, he adds that it is necessary that the manner of the heaven's movement be either the first principle of all motions (which is impossible, because all motion has a movent cause) or else there must be said to be some other principle of its motion. Consequently it is reasonable to ask why it is that the heaven is moved in this direction rather than some other.

p 2-31

364. Then at [†277] he shows the difficulty of this question. And he says that the very desire to attentively set forth difficult and occult things and give their cause, and to inquire into all the aspects, without omitting anything, will perhaps be seen as a sign either of a deep-rooted stupidity, causing one to be unable to distinguish between what is easy and what is difficult, or else as a sign of "great promptitude," i.e., of great

presumption, causing one not to know the measure of his ability with respect to the search for truth. And although some deserve rebuke on this point, it is not a just thing to condemn all investigators indiscriminately. Rather we should first have regard to two things.

p 2-31

First we must look for the motive which induces a man to speak of such things: Is he doing it out of love for the truth or in order to show off his wisdom? Secondly, we must consider how one is in assenting to the things he asserts: Does he have a weak certitude about them like the common run of mankind, or does he know them more firmly, i.e., above the general run? When, therefore, a person can attain to a knowledge of necessary causes with greater certitude than the general run of man, he who finds such necessary reasons deserves our thanks rather than a rebuke.

p 2-31

365. Then at [†278] he solves the question he raised. And he says that if thanks should be rendered to those who discover more certain necessary things, as to the present question it is enough to say how the matter seems to us, even though it is not so certain. He says, therefore, that among things that come to be produced, nature always does what is best, as moved and directed by the first principle, which is the essence of goodness. Now, we observe that a local motion is more noble to the extent that it tends toward a nobler direction — for the species of a motion is determined by its terminus. Thus with regard to straight local motions, a local motion toward a higher place is more honorable and more noble than one to a nether place, since the place which is above is of more worth than one which is down.

p 2-31

This fact is also plain with regard to man: for the head, which is above, is nobler than the feet, which are down. Likewise, the front of a man is nobler than the back, and the right than the left, as we have said above, and as is plain also with respect to animals.

p 2-31

Therefore the question under discussion testifies to the fact that in the heaven there is a before and an after, i.e., a front and a back, which things he did not mention previously. Now it is this, namely, the distinction between front and back in the heaven, that solves the question at hand. For if the motion of the heaven is the best possible, as has been maintained, then the cause in the aforesaid question is this: It is best for the heaven to be moved with a "simple" motion, i.e., always toward the same direction and one "without any interruption," i.e., without the interpolation of rest (which would have to occur if the heaven were now moving in this direction and now in that direction); furthermore, it is best that it be moved toward the nobler part of the direction, and the front part is the more noble. And that is why the heaven is moved from the east toward its "front," i.e., toward the upper hemisphere and not toward the lower, which is the "back" of the heaven.

p 2-32

366. But this argument does not seem appropriate. For above he had explained the distinction of these parts in the heaven from the beginning of motion, namely, from the fact that the motion of the heaven seems to begin from one direction and not from another. But here he assigns the reason why the heaven is moved the way it is and not some other way, from the distinction of the parts of the heaven. Consequently, he seems to be arguing in a circle.

p 2-32

To this it should be answered that the distinction among the parts of the heaven is the reason why the motion of the heaven begins whence it does and not elsewhere; and not conversely. But the fact that the motion does begin whence it does and not somewhere else is a sign of the distinction of the parts of the

motion does begin whence it does and not somewhere else is a sign of the distinction of the parts of the heaven. Now the cause of the distinction of these parts is the power of the soul moving the heaven, or of some intellectual substance differently applied to the different parts of the heaven. There is nothing wrong, when asking "Whether something is," should one prove with a sign; but when one is dealing with the "reason why something is;" the sign must be reduced to the cause. For example, we might prove that the heart is moved by the motion of the pulsating vein; but if we should ask what is the cause of the motion of the pulsating vein, it will be said that it is because of the heart's movement. In like manner, Aristotle, from the fact that the motion of the heaven begins at a certain part, proved, as though from a sign, that there is such-and-such a distinction of parts in the heaven. Nevertheless he reduces the beginning of the motion to the difference in the parts of the heaven, as to the cause.

p 2-32

Now the front and rear of the heaven are distinguished, not naturally, namely, in terms of some specific part of the heavenly body (since one and the same part of the heavenly body which is now in the upper hemisphere will later be in the lower), but in terms of position, just as was stated above concerning the difference between the right and left [sides of the heaven].

Lecture 8 (Aristotle's Text)

288a14-288b6

[279] We have next to show that the movement of the heaven is regular and not irregular. [280] This applies only to the first heaven and the first movement; for the lower spheres exhibit a composition of several movements into one. [281] If the movement is uneven, clearly there will be acceleration, maximum speed, and retardation, since these appear in all irregular motions. The maximum may occur either at the starting-point or at the goal or between the two; and we expect natural motion to reach its maximum at the goal, unnatural motion at the starting-point, and missiles midway between the two. †1 But circular movement, having no beginning or limit or middle in the direct sense of the words, has neither whence nor whither nor middle: for in time it is eternal, and in length it returns upon itself without a break. If then its movement has no maximum, it can have no irregularity, since irregularity is produced by retardation and acceleration. [282] Further, since everything that is moved is moved by something, the cause of the irregularity of movement must lie either in the mover or in the moved or in both. For if the mover moved not always with the same force, or if the moved were altered and did not remain the same, or if both were to change, the result might well be an irregular movement in the moved. But none of these possibilities can be conceived as actual in the case of the heavens. As to that which is moved, we have shown that it is primary and simple and ungenerated and indestructible and generally unchanging; and the mover has an even better right to these attributes. It is the primary that moves the primary, the simple the simple, the indestructible and ungenerated that which is indestructible and ungenerated. Since then that which is moved, being a body, is nevertheless unchanging, how should the mover, which is incorporeal, be changed?

288b7-288b8

It follows then, further, that the motion cannot be irregular.

Lecture 8 (Aquinas' Commentary)

p 2-33

Lecture 8

The regularity, or uniform velocity, of the heaven's motion shown by two arguments

p 2-33

367. After assigning the reason why the heaven is moved toward one direction rather than the other, the Philosopher here discusses the uniformity of the heaven's motion.

p 2-33

First he proposes what he intends:

Secondly, he proves his proposition, at 369.

p 2-33

About the first he does two things:

First he proposes what he intends [†279], and says that after the foregoing we must "cover," i.e., say something briefly about, the motion of the heaven and show that it is "regular," i.e., that it always has a uniform velocity, and is never irregular so as to be at one time slower and at another swifter. And this is reasonable: for this motion is the rule and measure of all other motions. Hence no irregularity or inequality should appear in it.

p 2-33

368. Secondly, at [†280] he explains what he had said. And he says that he intends here to speak of the "first heaven," i.e., the outermost sphere and of the "first carrying," i.e., of the diurnal motion by which the whole heaven is revolved, though the motion of the first mobile, from east to west. Now he speaks of this motion in particular because there is in it no irregularity either in fact or in appearance. But "in those things below," i.e., in the motion of the planets, several motions concur to move one body, either according to different shifting and revolving spheres, as the astronomers of Aristotle's time said, as is plain in *Metaphysics* XII, or according to the motions of eccentrics and epicycles according to modern astronomers. From this variety of motions is caused the irregularity which appears as to the planets, according to which they seem at one time to be moved with a forward motion, at another with a retrograde, and at still another to be at rest — although in fact no motion of the heaven is irregular. Now, the arguments which he will here adduce apply not only to the motion of the first heaven which is simple and hence gives no appearance of irregularity, but also to the motions of the planets, in which there is apparent irregularity due to the concurrence of many motions.

p 2-33

369. Then at [†281] he proves his proposition with four arguments. The first is taken from the very form of circular motion, and proceeds thus: If the first heaven were moved in an irregular manner there would obviously have to be "intension," i.e., an increase of velocity, and "power," i.e., a maximum velocity, and "remission," i.e., a decrease of velocity. For every irregular motion possesses all three. This is not in the sense that these three are found in each and every irregular or unequal motion, but in the sense that in any motion two of them are found. Thus "power" [a maximum] and "intension" [an increase] are found, as they are found in the natural motion of heavy and light bodies, since such motion is always increasing in velocity up to the end, when it is at its swiftest; on the other hand, when such bodies are subjected to a motion contrary to their nature, there is "power" [a maximum] and "remission" [a decrease], because in the beginning such a motion is swiftest but its velocity is continually decreased until at last the whole motion is exhausted. Thus the word "every" is taken collectively in the sense that these three things are found in all motions that are irregular but not all in each one.

p 2-34

370. Then he shows where the maximum speed is found in an irregular motion. And he says that the "power" of a motion, i.e., its maximum speed, is found either "whence it is brought forth," at the terminus a *quo,* or "whither it is borne," i.e., at the terminus *ad quem,* or near the middle. Thus, in things that are being naturally moved with a straight motion the greatest velocity is toward the terminus toward which they are borne, since a natural motion is intensified at the end, as was had in Book I; while in things that are moved contrary to nature, the greatest velocity is found "whence," i.e., toward the terminus *a quo,* since a violent motion is intense in the beginning and slackens at the end, as was had in Book I. But in things projected, the maximum velocity is found near the middle.

371. Now there is a question about what the Philosopher here calls "things projected." For things that are projected are moved either according to a natural motion, as when a stone is thrown downward, in which case it is seen that the motion is increased at the end, or they are moved with compulsion, as when a stone is thrown upward, in which case its motion must be most intense at the beginning, and not in the middle.

But Simplicius says that by "things projected" the Philosopher here means the bodies of animals, whose soul does not move them directly upward or downward but, as it were, laterally, after the manner of an arrow and other projectiles, and that is why Aristotle here calls them things projected. Now it is plain [Simplicius continues], that in the case of the motions of animals, the maximum velocity is found neither in the beginning, when animals in a sense gradually depute their members to motion, or at the end, when their members are now tired, but near the middle, when they are in the very onrush of their motion.

However, this seems to be a forced explanation. For this reason, Alexander says that "middle" here should refer to the place, and not to the time. For the motion of an arrow and of other things similarly projected is neither upward nor downward, but in what is intermediate to both these, and it is in this intermediate area that the maximum velocity of these motions is reached.

But we cay say that even if we take "middle" as referring to time, such projectiles still move more swiftly near the middle. For the motion of such projectiles is caused from the impulsion of the deferent medium which more easily receives the impression of the mover than does the heavy body that is projected, as is plain in *Physics* VIII. Consequently, after much air has now been set in motion, the motion of projection is swifter in the middle than at the beginning, when still only little air was being set in motion, or at the end, when the impulsion of the one projecting has already begun to fade. And a sign of this is that such projectiles do not strike with as much force an object which is entirely near or which is very remote as they do one which is at a mediate distance.

372. Thus it is plain, therefore, that the maximum velocity of any irregular motion is either at the beginning, or in the middle, or at the end. But these three are not to be found in the circular movement of the heavenly body — neither with respect to time (since it is eternal according to his opinion) nor with respect to "length," i.e., with respect to the shape of the place, which is along a circular line "drawn around," i.e., as though always returning circularly to itself, and "unbreakable," i.e., not divided in act so as to allow an actual beginning and an end to be designated in it. Therefore in the revolution of the heaven there is no "power," i.e., maximum velocity, discernible at any part, and, as a consequence, no irregularity, which is due increase and remission.

373. He gives at [†282] the second argument which is taken at once on the part of the mover and mobile. For it has been shown in *Physics* VII and VIII that whatever is moved is moved by some movent. Consequently, if there is irregularity in a motion, it must be due either to the movent, or to the thing moved, or to both. For if the movent does not move always and with equal power, but sometimes with more and sometimes with less, the motion will be sometimes slower, sometimes swifter. For the velocity of a motion results from the fact that the power of the movent, on account of its size, greatly dominates the mobile. And similarly, if the body being subjected to motion, by virtue of some alteration, does not maintain the same state, it will not be at all times equally subject to the power of the movent, and so there will not be an equal

speed of motion. Finally, if both are modified, namely, the movent and the mobile, the motion could be irregular.

p 2-35

But none of these possibilities can be verified with regard to the heaven. For it has been shown above that the mobile body here involved is first and simple, since it is moved by a first and simple motion; moreover, that it is ungenerated, indestructible and utterly unchangeable (i.e., with a change causing a variance in substance or strength). Now there is all the more reason for the mover of such a body to be of such a condition. For since the mover is more powerful than the moved, if the body which is moved is a primary and simple body and subject neither to generation nor corruption, so much the more so will its mover be. It was also shown in *Physics* VIII that the mover of the heaven is incorporeal and without any magnitude. If then the heaven, which is a body, is not changed in the state of its substance and strength, much less will its mover, which is incorporeal, be changed. From this it is plain that it is impossible for the motion of the heaven to be irregular.

Lecture 9 (Aristotle's Text)

[283] For if irregularity occurs, there must be change either in the movement as a whole, from fast to slow and slow to fast, or in its parts. That there is no irregularity in the parts is obvious, since, if there were, some divergence of the stars would have taken place †1 before now in the infinity of time, as one moved slower and another faster: but no alteration of their intervals is ever observed. Nor again is a change in the movement as a whole admissible. Retardation is always due to incapacity, and incapacity is unnatural. The incapacities of animals, age, decay, and the like, are all unnatural, due, it seems, to the fact that the whole animal complex is made up of materials which differ in respect of their proper places, and no single part occupies its own place. If therefore that which is primary contains nothing unnatural, being simple and unmixed and in its proper place and having no contrary, then it has no place for incapacity, nor, consequently, for retardation or (since acceleration involves retardation) for acceleration. [284] Again, it is inconceivable that the mover should first show incapacity for an infinite time, and capacity afterwards for another infinity. For clearly nothing which, like incapacity, is unnatural ever continues for an infinity of time; nor does the unnatural endure as long as the natural, or any form of incapacity as long as the capacity. †1 But if the movement is retarded it must necessarily be retarded for an infinite time. †2 [285] Equally impossible is perpetual acceleration or perpetual retardation. For such movement would be infinite and indefinite, †3 but every movement, in our view, proceeds from one point to another and is definite in character. [286] Again, suppose one assumes a minimum time in less than which the heaven could not complete its movement. For, as a given walk or a given exercise on the harp cannot take any and every time, but every performance has its definite minimum time which is unsurpassable, so, one might suppose, the movement of the heaven could not be completed in any and every time. But in that case perpetual acceleration is impossible (and, equally, perpetual retardation: for the argument holds of both and each), †4 if we may take acceleration to proceed by identical or increasing additions of speed and for an infinite time. [287] The remaining alternative is to say that the movement exhibits an alternation of slower and faster: but this is a mere fiction and quite inconceivable. Further, irregularity of this kind would be particularly unlikely to pass unobserved, since contrast makes observation easy.

[288] That there is one heaven, then, only, and that it is ungenerated and eternal, and further that its movement is regular, has now been sufficiently explained.

Lecture 9 (Aquinas' Commentary)

p 2-36
Lecture 9

Two other arguments proving no irregularity in the motion of the heaven

p 2-36

374. Here the Philosopher gives the third argument which is taken solely from the viewpoint of the mobile [†283]. And he says that if the motion of the heaven were executed irregularly this would be either in such a way that the entire change of the heaven would vary in such a way as to be now slower, now swifter, or else parts of it would vary. The phrase "entire change" refers to the motion of the whole highest sphere, while "parts" of the change refers to the motions of the parts of the heaven.

p 2-36

But that the parts of the supreme sphere are not moved irregularly so that one part of the heaven moves now swifter and now slower, he shows on the supposition that the sphere of the fixed stars is the supreme sphere. For in his [Aristotle's] time it had not yet been discovered that the fixed stars, in addition to the diurnal motion of the heaven, had a motion of their own [the precession of the equinox]. And therefore he attributes the first motion, namely, the diurnal motion, to the sphere of the fixed stars, as though proper to it. Later astronomers, however, assert the sphere of the fixed stars to have a certain proper motion, above which they place another sphere to which they attribute the first motion.

p 2-36

On the supposition, therefore, that the sphere of the fixed stars is the supreme [outermost] sphere, he proves that its parts are not moved irregularly. For if its individual parts were moved now slower, now faster, then over a long period of time the fixed stars would have come to have different distances between themselves than previously as a result of one star moving faster and another slower. But the contrary of this appears. For they are found to retain the same configuration, and to be at the same distance from one another, now as when these were established by the earliest observers. Therefore there is no irregularity in the motion of the first heaven so far as its parts are concerned.

p 2-36

375. But if we pass from the parts to the whole "change" of the first heaven, there is no variation in velocity to a remission of velocity either. For it is plain that the slowing down of a mobile's motion is due to lack of power, just as, when the bodies of animals become tired, their motion slows down. But all impotency and defect is against nature, as is plain in animals, in which old age and decrease and other things of the sort are against nature.

p 2-36

This of course is to be understood with respect to the particular nature, which preserves the individual as far as it can; hence it is against its intent that it be deficient in conserving. But it is not against universal nature, which is the cause not only of generation but also of corruption and, consequently, of the other defects that lead to corruption in the lower bodies. By universal nature is meant the active power present in a universal cause, for example, in the heavenly body.

p 2-36

Now the reason why defects beyond the particular nature can occur in animals is that the whole substance of an animal is a resultant of bodies that are outside their appropriate places. For the body of an animal is composed of the four elements, none of which is in its own proper place. And because those things which are "outside nature" cannot last forever, as is evident from what has been stated above, necessarily corruption and defect will occur at some time to animals. But in the first bodies, namely, the heavenly bodies, nothing "outside nature" can happen, for they are simple things and not mixtures of various elements; moreover, they are in their appropriate place and there is nothing contrary to them, as is plain from what was said in Book I. Hence no impotency can be found in them. Therefore, too, there cannot be in them any "remission," i.e., decrease of velocity, and consequently any "intension," i.e., increase of

velocity, because these two follow upon each other — for just as a motion, when it is intensified, proceeds from "remiss" to "intense," so when it diminishes, it goes from "intense" to "remiss."

p 2-37

376. The fourth argument, at [†284] is considered from the standpoint of the mover, and proceeds from a certain division. For if there is intensity and remission in the motion of the heaven, this can take place in only three ways: In one way, it might be always growing in intensity or always becoming remiss; in another way, it could at one time be getting intense and at another time be getting remiss, and this in two ways — in one way, such that the whole intensity and the whole remission would occur at once, on which follows (supposing, according to his opinion, that the heaven is moved for infinite time), that for an infinite time its motion first becomes intense and later becomes remiss, or conversely; in another way so that it alternates between successive states of intensity and remission. But each one of these is impossible. Therefore, it is impossible for remission and intensity to occur in the motion of the heaven.

p 2-37

First, therefore he shows that it is impossible for that motion to become intense for an infinite time and later become remiss for an infinite time, or conversely;

Secondly, he shows that it is impossible for it to be always becoming intense or always becoming remiss, at 378;

Thirdly, he shows that it cannot be alternately becoming intense and remiss, at 381.

p 2-37

377. He says therefore first [†284] that it is unreasonable to suppose that the mover of the heaven for an infinite time is in power and moves swiftly, and then for another infinite time is weak and moves slowly (for remission of motion is due to lack of power, whereas intensity is due to power).

p 2-37

The same conclusion that this is unreasonable, he now proves through two middles. First, because nothing contrary to nature is seen to exist for an infinite time — for things according to nature exist always or for the most part. Now lack of power is contrary to nature, as was had. Therefore, it is impossible for anything to be deficient in power for an infinite time.

p 2-37

Secondly, because the time is not equal in the case of that which is according to nature and in the case of that which is not according to nature — for that which is not according to nature occurs in a few cases only, whereas what is according to nature happens for the most part or always. But the power of a thing is according to nature, whereas defect of strength is "outside" nature. Therefore, it is impossible for anything for an equal period of time, namely, for an infinite time, to be in power and powerless. Consequently, it is also impossible for motion to become intense for an infinite time and then to become remiss for an infinite time. But if the motion of the heaven becomes remiss in the manner described, it must become so for an infinite time.

p 2-38

Now some, not understanding Aristotle's intention, take this as stated absolutely on the ground that there is no reason why it should become remiss at one time rather than another. But this is not according to his intention.

p 2-38

378. Then at [†285] he shows that it is impossible for the motion of the heaven to become always more intense or to become always more remiss. He shows this with two arguments. The first of these is that the intensity and remission of any irregular motion cease near some terminus of the motion, just as a natural motion becomes intense up to a certain terminal point and as a violent motion becomes remiss up to a certain terminal point. If, therefore, the intensity or remission of the motion of the heaven should be never terminated but proceed *ad infinitum,* it would follow that the motion of the heaven would be infinite and undeterminate. Now this is plainly false, for it has been proved in *Physics* VI that, since every motion proceeds from something to something, it must necessarily be determinate. For this reason even a single revolution of the heaven is determinate. It is only according to the various revolutions that succeed one another that the motion of the heaven is said to be infinite.

p 2-38

379. The second argument on this point he gives at [†286]. And he says, that this is impossible is also evident if you grant that there is a minimum time, in less than which the heaven cannot be moved. For every motion or action involves a determinate time that it cannot ignore. Thus, although time is divisible *ad infinitum,* yet it is not possible to play the harp or walk in just any time whatever; rather, every action requires a minimum of time which it cannot exceed by speed, in such a way as for it to be performed in less time. For this reason it is not possible for the heaven to be moved in just any period of time, but rather it has some definite minimum time. From this it is clear that the speed of its motion is not forever being increased, because then its speed would exceed any minimum time whatever. Now if the speed of the heavenly motion cannot be always increasing, then for the same reason it cannot be always decreasing, because the same argument applies to both — for just as there is a minimum time required for an action, so too there is a maximum in which it takes place.

p 2-38

380. But someone could object to this argument and say that the velocity of the heavenly motion can be always increasing, without, nevertheless, some minimum given time ever being transgressed, so long as any addition of speed is not equal or greater but is always smaller and smaller. For it is said in *Physics* III that if a line be divided according to the same proportion, for example, by taking 1/3 from the whole line and then 1/3 from the remainder, and again 1/3 from that remainder, the process could go on *ad infinitum;* and if the segments removed subsequently be added to what was removed earlier, the process of adding will continue forever without ever arriving at the quantity of the whole line, because there will always be some part left of the line which is being divided. However, if one always takes a part of equal or greater quantity, and it is added to what was taken previously, one will necessarily exceed any pre-determined quantity.

p 2-38

And he says that we should understand this case similarly in the sense of every minimum given time's being surpassed, which is to exceed every greatness of velocity, by the addition, over an infinite time, of equal or greater speed. For if a great velocity were first added, and then a lesser one, and so on, as was said in the division and addition of a line, not every velocity or every minimum time would be transcended, since there would not be a pure intensification, but an intensification combined with remission, because the mover would not be able always to make equal additions to the velocity.

p 2-39

381. Then at [†287] he shows that it is impossible for the motion of the heaven to be alternately intensified and remitted, and this for two reasons. First, such a thing is seen to be utterly unreasonable, and like something imaginary — since no reason for this alternation can be assigned. Secondly, such diversity in the motion of the heaven would not escape observation — for when two opposites are juxtaposed, their differences become more striking. Yet we perceive no such variations. Hence it remains that there is no

irregularity in the motion of the heaven.

p 2-39

Finally, at [†288], because he here puts an end to his consideration of the whole heaven, he states in summary that so far it has been said that there is one single heaven, and that it is ungenerated and eternal, and it is moved with a regular motion.

Lecture 10 (Aristotle's Text)

289a13-289a34

[289] We have next to speak of the stars, as they are called, of their composition, shape, and movements. [290] It would be most natural and consequent upon what has been said that each of the stars should be composed of that substance in which their path lies, †1 since, as we said, there is an element whose natural movement is circular. [291] In so saying we are only following the same line of thought as those who say that the stars are fiery because they believe the upper body to be fire, the presumption being that a thing is composed of the same stuff as that in which it is situated. [292] The warmth and light which proceed from them are caused by the friction set up in the air by their motion. Movement tends to create fire in wood, stone, and iron; and with even more reason should it have that effect on air, a substance which is closer to fire than these. †2 An example is that of missiles, which as they move are themselves fired so strongly that leaden balls are melted; and if they are fired the surrounding air must be similarly affected. [293] Now while the missiles are heated by reason of their motion in air, which is turned into fire by the agitation produced by their movement, †3 the upper bodies are carried on a moving sphere, so that, though they are not themselves fired, yet the air underneath the sphere of the revolving body is necessarily heated by its motion, [294] and particularly in that part where the sun is attached to it. †1 Hence warmth increases as the sun gets nearer or higher or overhead. [295] Of the fact, then, that the stars are neither fiery nor move in fire, enough has been said.

Lecture 10 (Aquinas' Commentary)

p 2-40

Lecture 10

On the nature of the stars

p 2-40

382. After settling the question of the heaven, the Philosopher now treats of the stars.

First he determines the truth;

Secondly, he raises and settles some doubts (L. 17).

As to the first he does four things:

First he determines the nature of the stars;

Secondly, their motion (L. 11);

Thirdly, their order (L. 15);

Fourthly, their shape (L. 16).

With respect to the first he does three things:

First he states his intention;

Secondly, he manifests the truth at 383;

Thirdly, he excludes an objection, at 387.

He says therefore first [†289] that, after having determined the question of the whole heaven, we should next consider those things called "stars" and determine "what they are made out of," i.e., of what nature they are, and what shape they have, and of what sort are their motions.

383. Then at [†290] he shows of what nature the stars are. First he proposes what he intends, and says that the assumption that each star is of the nature of the spherical body in which it is moved is of itself most reasonable, since places follow upon the natures of bodies. Hence it is reasonable that the stars pertain to the nature of the sphere in which they are situated. Moreover, this follows of necessity from what we have said above. For it was said that the heaven has a nature other than the nature of the four elements, since it has a motion distinct from the motions of the [four] elements, namely, a circular motion. Hence, since the stars are moved circularly as the heavenly spheres are, the consequence is that they have a nature in common with the heavenly spheres and differ from the nature of the four elements.

384. But there seems to be a twofold doubt on this matter. The first one arises from the fact that the bodies of the stars appear to differ from the bodies of the heavenly spheres, since they shine and seem to be more compact; consequently, there seems to be contrariety in the heavenly bodies. Now contrariety is the cause of corruption. It seems, therefore, that heavenly bodies are according to their nature corruptible, which is against what has been determined in Book I.

The answer to this is that not every diversity, strictly speaking, has the notion of contrariety. Rather, in

order that things be contrary, two things are required: One of these is that they be apt to exist in some way in the same subject, whether proximate, or at least remote — thus heat is contrary to cold, which latter, however, is not apt to exist in fire, but is apt to exist in the matter of fire, which is the first subject. Secondly, it is required that the diverse things that are contrary not be able to exist together, but mutually expel one another. Hence, white and black, as existing in matter, are contraries mutually expelling one another. But as existing in the intellect they have no contrariety but can exist together; as a matter of fact, one of them is known through the other.

p 2-41

Now the differing forms or qualities that seem to be in the heavenly bodies are in no sense apt to exist in the same subject, whether it be a proximate subject or a first subject — for the body of a star is not apt to be reduced to the disposition of the other parts of the heavenly spheres, or vice versa.

p 2-41

Similarly, it is also necessary to say that the contrary forms or qualities found in the lower bodies exist in some sense in heavenly bodies, not, indeed, in a univocal way, but as in universal causes, in a certain likeness to the manner in which forms that exist individually in sensible matter, exist universally in the intellect. Hence, just as in the intellect they do not exist under the notion of contrariety, so neither do they in the heavenly bodies. Hence Plato said that in the heavenly bodies are found the excellences or sublimations of the elements, the former being, as it were, their primordial active principles — for the heavenly bodies are related to elementary bodies as are active principles to passive. Therefore the opposite happens in heavenly bodies and in elementary bodies. For elementary bodies, the more compact they are made as a result of thickening, the more material, and passive, and less light-endowed they are. This is evident with respect to earth, which is the dominant factor in mixed bodies. On the other hand, in the heavenly bodies, the more compact they are as a result of thickening, the greater their luminosity and active power, as is plain in the bodies of the stars.

p 2-41

Consequently, it is plain that such diversity as is apparent in the heavenly bodies is not seen to possess the nature of contrariety. Therefore, it does not follow that they are susceptible to corruption. But that would follow if there were true contrariety, as Aristotle showed in Book I.

p 2-41

385. The second doubt is to the effect that, since diversity appears between the stars and the remaining parts of the spheres, it seems that they are not simple bodies. But the answer to this is that these bodies are called simple to the extent that they are not composed of contrary natures. Yet there is in them some diversity with respect to the nature of their species, although they agree in the nature of their genus — thus they agree in the common aspect of their motion, because all are moved circularly.

p 2-41

386. Secondly, at [†291] he shows that this is in a way in agreement with the statements of others. For he says that, just as those who assert that the stars are fiery, concluded this because they believe the heavenly body is fire, as though it were reasonable for each of the stars to consist of the nature of those spheres in which it exists; so, too, we assert that the stars are of a nature different from the nature of the four elements, because we have previously proved the heavens to be such.

p 2-41

387. Then at [†292] he excludes an objection; for some believed the stars to be of the nature of fire and argued in the following manner: To be hot and luminous is seen to be proper to fire. But the stars heat and give light. Therefore, it seems that they are of the nature of fire.

p 2-42

Regarding this he does three things:

First he resolves this objection with an example;

Secondly, he shows how the example differs from his proposition, at 388;

Thirdly, he replies to a tacit question, at 389.

p 2-42

He says therefore first [†292] that heat and light are generated by the stars by a certain stroking of, or friction with, air and not because they are of a fiery nature. For we observe that motion is apt to ignite wood and stones and iron; hence it is all the more reasonable that a body which is more like fire than the bodies mentioned should be ignited by motion, because when two things are more alike, it is easier for them to change into each other. But air is more like fire than the above mentioned bodies are. Hence air can be more easily ignited by motion than those bodies. And he gives the example of arrows. Part of them being of lead, they are so heated by the violence of their motion that sometimes the lead melts. Since arrows can be ignited as a result of motion, there is all the more reason why the air surrounding the arrows should become ignited. This does not mean that the heated arrow causes the air to become heated, as Simplicius understood. Rather, it is to be understood that the heat produced in the air through motion causes the heating of the arrows, as Alexander explained it. For Aristotle wishes to prove from a lesser case that if arrows are heated, the surrounding air must be heated, it being closer to fire, as he said above. He is not taking the case [of the heated arrow] as a cause, as Simplicius understood.

p 2-42

388. Then at [†293] he shows the difference between this example and his proposition. And he says that those arrows become hot because they are being moved through air, and the air becomes ignited by the "blow," i.e., as a result of its being struck and divided by the arrow; hence it is from contact with heated air that the arrows become hot. But this is not what happens in the stars, since each star is not being moved through air but in its own sphere insulated from air. Therefore, the stars are neither ignited nor made hot, first of all because they are far from air, which is ignited by motion, and, secondly, because they are not receptive to a transitory impression. But it is the air which exists under the sphere of the heavenly body that must become hot as a result of the motion of the heavenly sphere, since the motion of the heavenly sphere agitates not only the fire but the air as well (namely, as far as the air contained below the mountains), as is apparent from the motion of comets, as stated in *Meteor ology* I.

p 2-42

389. Then at [†294] he responds to a tacit objection. For if the lower air is ignited by the motion of the heavenly sphere, then, since the heavenly sphere is in continuous motion, it seems that there should always be an equal amount of heat in the air at all times, i.e., in winter and in summer, during the day and during the night. But we observe that it is the contrary that happens.

p 2-42

To this he responds that air is mainly ignited by the motion of the particular sphere in which the sun is fixed. Therefore heat is generated on account of the sun's nearness to us. And this happens in two ways: First, insofar as by its rising, the sun ascends to our upper hemisphere; secondly, insofar as it reaches a point directly overhead — for just as there is more heat during day than during night, so too there is more at noon than at dawn.

p 2-43

Lastly, he concludes [†295] by way of summary that so far we have said that the stars are not fiery in nature, and are not moved in a fiery body, but above the sphere of fire, in the heavenly spheres.

p 2-43

390. But a first doubt arises: Since Aristotle asserts that the motion of the stars generates heat and light, his proof seems insufficient, since he gives no evidence for light, but only for heat.

p 2-43

To this Alexander responds that he reserves his treatment of light for settling in his book, *On the Soul*, in the second part of which he states that light is not a peculiarity of fire but something common to it and to the supreme body.

p 2-43

However, since Aristotle says that both are generated from the striking of the air, it is better to say that Aristotle has taken care of both right here by showing that as a result of the stars' motion the lower bodies are set afire — for in fire are found both heat and light.

p 2-43

391. But a doubt still remains, namely, the doubt as to that nature whence motion has the power to ignite or heat things.

p 2-43

To this Averroes responds in his *Commentary* that it is proper to the hot to be mobile; consequently, when something is being moved in act, it also becomes hot in act.

p 2-43

But this is not seen to be true. First of all, because to be moved is not peculiar to the hot but is common to every natural body — for things moved with a straight motion rest when they are in their appropriate places, but are moved when they are outside their places; heavenly bodies are moved circularly in their places, which are neither hot nor cold. In the second place, the subsequent is not the cause of the prior — hence, if motion were proper to what is hot, heat would be the cause of motion rather than motion the cause of heat.

p 2-43

Therefore, it must be said that, as is proved in *Physics* VIII, local motion is the first of motions. Now in every genus, whatever is first is the cause of the things that are subsequent in that genus. Hence, local motion is the cause of alteration, which is the first motion among the other motions, and in particular the cause of the first alteration which is heating. For alteration in all the other qualities is caused by alteration in the first four qualities, among which the two active, namely, hot and cold, are prior to the passive, namely, moist and dry. But hot is prior to cold, as form is prior to privation, as is clear from what was said previously. Hence local motion is properly the cause of heat. However, every local motion possesses this from the power of the heavenly motion, which is the first of local motions.

p 2-43

392. Another doubt now arises: Since the sun immediately touches neither the air nor the fire, how is heat caused in the air and in fire from the motion of the sun? For the intermediate heavenly bodies, namely, the spheres of Venus, Mercury and the moon, are not heated from the motion of the sun. To this Alexander responds that there is nothing preventing a thing from being altered by an agent acting through a medium,

without the medium itself being altered. For example, the fish called *stupor* shocks the fisherman's hand through the net, although the net does not shock. Yet the net does receive in some way the impression from the fish, but in a manner different from the way the hand does. So, too, the sun imprints something on the intermediate heavenly bodies, even though it is not heating; but the effect of the sun reaches the lower bodies after the manner of heat, in keeping with their condition.

p 2-44

But against this answer appears to be the fact that Aristotle asserts that heat is caused in air that has been struck or compressed by the motion of the stars. But it is not possible for this striking or compressing effect from the motion of the sun to reach the air without the intermediate heavenly bodies also being struck, which is impossible.

p 2-44

Therefore Averroes in his *Commentary* says that the entire heavenly body is moved with the diurnal motion as though it were one body, or one whole animal, whereas the particular motions of the planets are as motions of the parts of an animal. Now heat in the air is caused mainly by the motion of the whole heaven, i.e., by the diurnal motion. For this reason Aristotle says that heat is caused by the nearness of the sun when it rises and is overhead, all of which is due to the diurnal motion. Now, it is plain that when one body alters another it does not do so only according to its outermost surface where it touches the body altered, but does this according to its whole depth or mass — and a sign of this is that a thin body is not as well suited for causing alteration as a body having thickness or mass, supposing that both bodies possess the same nature. Thus the whole heaven causes heat, not only in virtue of the lowest sphere, but in virtue of the whole mass of the heaven, as though by a single alteration. Therefore alteration takes place in those lower bodies not only in virtue of the moon's orb, which is in immediate contact with the lower bodies, but also according to the virtue of the stars, in which the active power of the heavenly body is more unified and as though massed together. This is particularly true of the sun, which exceeds the other bodies in power and size. Since, therefore, the whole heaven acts as one body according to its diurnal motion, we should not suppose that one sphere acts separately upon another, but that the whole heaven, with one imprint, alters the lower air by means of the power in the sun and other stars as they draw near to us.

p 2-44

But, as Simplicius says, even this explanation does not seem to be sufficient. First, because if heat were produced in the air on account of its being struck or compressed by the motion of the heavenly body when the sun is present, it would follow first of all that lower places would become less heated, since they are farther from the heating motion. But just the opposite is seen, for there is more heat on the plains than on the mountains. Secondly, since the sphere of the earth is almost like a point in relation to the sphere of the sun, when the sun is over the earth it seems to be more or less equally near to every part of the earth; consequently, there should not be such a great variation of heat from the sun as there is between dawn and noon, or winter and summer. Thirdly, because there would be no reason for finding less heat in shaded places than in places where the rays of the sun strike.

p 2-44

The same reasons prove that the sun does not cause heat as though it were of the nature of fire.

p 2-44

And therefore Simplicius says that there emerge from the body of the sun rays he says to be corporeal, and that they can without hindrance penetrate those heavenly bodies below the sun that are immaterial, and air they penetrate on account of its pores. But they are reflected by solid bodies, namely, earth and water, at equal angles (because, as perspective proves, all reflection occurs at equal angles). When, therefore, a solar ray strikes the earth diametrically, it is reflected back upon itself and thus there is produced a maximum

thickening, which causes maximum heat; and this happens when the sun is directly overhead. But as the sun declines from its overhead position, the distance between the reflection of its rays increases more and more, and consequently less heat is generated. This is the reason why in the winter, and at sunrise and sunset, there is less heat in the air, namely, because the solar rays strike the earth at angles which are more obtuse, with the result that the distance between the rays first striking and the reflected rays is increased. And it is for this reason that Aristotle purposely did not say unqualifiedly that as the sun gets nearer more heat is generated, but was careful to add, "as rising and when it is overhead," in order to give us to understand that the nearness is in reference to its nearness overhead and not in reference to the linear distance from the sun to us, because those distances to any part of the earth are almost equal.

p 2-45

Now if Simplicius means with these words that the rays are bodies which strike and thicken the air and thus produce heat, his statement is expressly false, for Aristotle in *On the Soul* II proves that a ray is neither a body nor an emanation from a body. But if, in saying that the rays are corporeal, he means that they act after the manner of bodies, in the sense that they are directly projected and are reflected from any dense body they cannot penetrate, then he speaks the truth — for such reflections, being caused by the counter-resistance of bodies, belong not only to bodies but also to qualities, since heat, too, is reflected when it meets an obstacle, as do other things of the same sort.

p 2-45

393. However, if one examines them diligently, all the things said on this point are true in some sense. For Aristotle says that "heat and light are generated by the stars as a result of the air being struck by their motion." Now it seems that this is not to be understood as meaning that heat and light are generated by the striking of the air caused by the motion of the heavenly bodies: for it is not a question here of the light of fire generated from motion, as previously stated, but of the light caused by the stars themselves insofar as they are light-giving things in act. Therefore, the cause of heat generated in lower bodies by the heavenly bodies is twofold: One cause is motion, and the other is light. Why motion is the cause of heating has been explained above. But we must not suppose that a mutual stroking or rubbing of a heavenly body and of air is the cause of heat; rather it is solely the motion produced in the air by the higher motion of the heavenly body. The higher air, and likewise fire, are moved by the diurnal motion of the entire heaven according to the power of the sun and all the stars, as Averroes says.

p 2-45

The second cause of the heating of lower bodies by the stars and especially the sun is light. It indeed has the power to heat insofar as it is an active quality of the first thing altering, namely, the heaven. Hence, it directly causes the first quality found in inferior bodies, namely, heat. And since this quality, namely, light, abounds more in the sun, the sun is especially capable of heating. But the rest of the heavenly bodies, insofar as they partake of light (which is the universal active power of heavenly bodies), have the power to produce heat. This extends even to the light of the moon, according to what the Philosopher says in his book, *On the Parts of Animals,* namely, that the nights of full moon are warmer, for which reason certain fish come to the surface of the water.

p 2-46

As to the statement that some stars cause things to be cool or moist, Averroes says in his *Commentary* that they do not do this *per se* but only insofar as producing a heat proportionate to each body; on which account he scolds Avicenna, who says that the stars cause both cooling and heating.

p 2-46

But Averroes does not speak correctly in this matter. For a thing is seen to be per accidens when it is not produced by the agent *per se*. But the heavenly bodies are the agent causes of the things that are here. If,

therefore, they did not *per se* cause cooling and moisture and so on, it would follow that such things would be *per accidens* in the universe. Moreover, since all the substantial forms of the lower bodies come to be from the power of the heavenly bodies, it follows that from their power are also the qualities consequent upon the species or forms of the elements, namely, hot, cold, wet and dry, and so on.

p 2-46

Accordingly, it must be said that all the heavenly bodies, in keeping with their common power of light, have the property of heating, but according to other peculiar powers attributed to specific bodies, they not only heat and cool, but also produce other corporeal effects in lower bodies. And in the matter of the influence of light and these powers, what Alexander says is true, namely, that the intermediate heavenly bodies receive an impression from the sun in a way different from the way the lower bodies do.

p 2-46

One should consider, therefore, that accordingly as heat is caused in lower bodies by the motion of the stars and of the whole heaven, the bodies nearer to the heaven, namely, fire and the upper region of the air, which are carried around according to the motion of the heaven, are hotter. But accordingly as heat is caused from the light of the stars, the lowest things are hotter, because in the upper regions the reflections of the rays are dispersed more. This also explains why many species of things on the earth are generated by the power of solar and stellar rays which are multiplied about the earth as a result of reflexion.

p 2-46

394. But Alexander raises a question here: If the heavenly bodies strike the air in their motion, it seems to follow that they can be touched and, consequently, that they are hot and cold — for those are the first tangible qualities, as is said in *On Generation* II.

p 2-46

But the answer to this is easily evident from what Aristotle says in *On Generation* I, namely, that things apt to act and be acted upon touch each other mutually, and that the qualities of such things are heat and cold. The heavenly bodies, however, act but are not acted upon. Hence, they touch without being touched. Hence, too, the tangible qualities in heavenly bodies are not there in the way they are in lower bodies; rather, they are present in a more eminent way, i.e., as existing in their active cause. For hot and cold, moist and dry, are not present therein, but the power that causes them is present therein. Similarly, neither do heavy and light exist there; but in place of these is an aptitude to circular motion. Finally, rare and dense are present in heavenly bodies, accordingly as the stars are thicker and more massive than their spheres; nevertheless this is not according to the difference of contrariety, but only according to increase or decrease of power proportionate to a greater or lesser aggregation of parts.

Lecture 11 (Aristotle's Text)

289b1-289b3

[296] Since changes evidently occur not only in the position of the stars but also in that of the whole heaven, there are three possibilities. Either (1) both are at rest, or (2) both are in motion, or (3) the one is at rest and the other in motion.

289b4-289b7

[297] (1) That both should be at rest is impossible; for, if the earth is at rest, the hypothesis does not account for the observations; and we take it as granted that the earth is at rest. It remains either that both are moved, or that the one is moved and the other at rest.

289b8-289b27

[298] (2) On the view, first, that both are in motion, we have the absurdity that the stars and the circles move with the same speed, i.e. that the pace of every star is that of the circle in which it moves. For star and circle are seen to come back to the same place at the same moment; from which it follows that the star has traversed the circle and the circle has completed its own movement, i.e. traversed its own circumference, at one and the same moment. [299] But it is difficult to conceive that the pace of each star should be exactly proportioned to the size of its circle. That the pace of each circle should be proportionate to its size is not absurd but inevitable: but that the same should be true of the movement of the stars contained in the circles is quite incredible. For if, on the one hand, we suppose that the star which moves on the greater circle is necessarily swifter, clearly we also admit that if stars shifted their position so as to exchange circles, the slower would become swifter and the swifter slower. But this would show that their movement was not their own, but due to the circles. If, on the other hand, the arrangement was a chance combination, the coincidence in every case of a greater circle with a swifter movement of the star contained in it is too much to believe. In one or two cases it might not inconceivably fall out so, but to imagine it in every case alike is a mere fiction. Besides, chance has no place in that which is natural, and what happens everywhere and in every case is no matter of chance.

289b28-289b30

[300] (3) The same absurdity is equally plain †1 if it is supposed that the circles stand still and that it is the stars themselves which move. For it will follow that the outer stars are the swifter, and that the pace of the stars corresponds to the size of their circles.

289b31-290a6

[301] Since, then, we cannot reasonably suppose either that both are in motion or that the star alone moves, the remaining alternative is that the circles should move, while the stars are at rest and move with the circles to which they are attached. Only on this supposition are we involved in no absurd consequence. For, in the first place, the quicker movement of the larger circle is natural when all the circles are attached to the same centre. Whenever bodies are moving with their proper motion, the larger moves quicker. It is the same here with the revolving bodies: for the arc intercepted by two radii will be larger in the larger circle, and hence it is not surprising that the revolution of the larger circle should take the same time as that of the smaller. And secondly, the fact that the heavens do not break in pieces follows not only from this but also from the proof already given †1 of the continuity of the whole.

Lecture 11 (Aquinas' Commentary)

p 2-47

Lecture 11

Proof that the stars move, not of themselves, but as carried by the motion of the spheres, from a comparison with their circles

p 2-47

395. After showing what the nature of the stars is, the Philosopher here determines their motion.

p 2-47

First he shows how the stars are moved;

Secondly, he shows whether a sound is produced as a result of their motion (L. 14).

p 2-47

With respect to the first he shows, by three arguments, that the stars do not move of themselves but are carried along by the motion of their orbs. The first of these arguments rests on comparing the stars to the orbs [or spheres].

p 2-47

In this argument he presupposes a fact which is sensibly evident: we see the stars and the whole heaven moving. Now there are three ways in which this must happen: In one way, so that both the star and its orb are at rest; in another, so that both are in motion; in a third, so that one of them is at rest and the other in motion. Then having presented this division, he considers each one.

p 2-47

396. First he considers the first one [†297], and says that it is impossible that both, i.e., the star and its orb, be at rest if we assume that the earth is also at rest. For the apparent motion of the stars cannot be saved if both the stars which appear to be in motion are at rest, and the men who see them. For, that motion should appear, this must be caused either by the motion of the thing seen or of the one seeing. For this reason, some, positing the stars and the whole heaven to be at rest, posited the earth on which we live to be moved from west to east around the equinoxial poles [i.e., its axis] once a day. According to this, it is due to our own motion that the stars seem to move in a contrary direction. This is said to have been the opinion of Heraclitus of Pontus and Aristarchus. However, Aristotle is supposing for the present that the earth is at rest — which fact he will later prove. Hence it remains, the first member, in which the heaven and the stars were assumed to be at rest, having been set aside, to verify one of the two others — namely, that stating that both, i.e., the star and the orb, are in motion, or that stating one to be in motion and the other at rest.

p 2-47

397. Then at [†298] he destroys one member, namely, that holding both the star and the orb as being in motion. And he says that if both are being moved, something unreasonable is seen to follow, namely, that

there is the same velocity for the star and the circle carrying it. For if both are being moved, then we must say that the velocity of each star is equal to that of the circle in which it is being carried — for the stars appear along with their circles, returning to the same spot whence they had begun to be moved.

p 2-47

This is indeed very plain if we speak of the fixed stars which exist in the eighth sphere. For all such stars are seen to move together with the whole sphere with one motion, in such a way that a star in the equinoxial circle [i.e., the equator], which is the largest circle dividing the sphere through its center, completes its whole great circle in the same time that another star, in a smaller circle located toward one of the poles, completes its small circle. Consequently, since a thing is swifter if it covers a greater distance in equal time, as is plain from *Physics* VI, it follows that the larger the circle in which a star exists, the swifter its motion. Similarly, the larger the circle itself is, the swifter its motion.

p 2-48

This explanation can also be understood, as Alexander says, in adaptation to the circles of the planets. For to the extent that the planets are moved by the diurnal motion, they are revolved along with the supreme sphere, except insofar as the planets through their own motions retrogress somewhat in their own circles. And since the circle of the superior planet is larger, that planet will be swifter as to its diurnal motion — for in the same time it is being revolved through a larger circle.

p 2-48

Thus, therefore, it happens to some extent, both to the fixed stars and the planets, that the star is at once completing a complete circle while that circle itself is moved by a motion of its own as it traverses its own "periphery," i.e., circumference. This is to be understood in the sense that some designated point in the circle returns to its original place.

p 2-48

398. Therefore, having shown what happens from the assumption of equal velocities for the stars and for their circles, he shows that this is unreasonable, as he had supposed, at [†299].

p 2-48

First of all he proposes that it is not reasonable that there should be a same proportion between the velocity of the stars and the size of their circles, so that by so much is a star swifter as it is moved in a larger circle.

p 2-48

Secondly, he shows that it is not unreasonable to say this of the circles themselves. Indeed, it seems to be necessary that their velocities be "analogous," i.e., proportionate, to their sizes — since that is what we see in all natural bodies; namely, that so much the greater something is, so much the swifter does it move by its proper motion. Consequently, if it is not reasonable for the velocity of the stars to be proportionate to the size of their circles, it is nevertheless reasonable for the velocity of the circles to be proportionate to their own size. From this it follows that it is unreasonable for the velocity of the stars and of the circles to be equal.

p 2-48

That it is not reasonable for the motion of each star to be proportionate in velocity to the size of its circle he shows in the following way: Such a thing would happen either from necessity of nature or from chance. But if it should occur from natural necessity that a star be swifter on account of being moved in a larger circle, it follows that if stars were transposed into other circles, so that a star previously in a larger circle should be placed in a smaller circle, then the star that previously was slower would be faster, and vice

versa. So, it will appear that the stars do not possess a motion of their own but are moved by the circles — from the fact that a star does not preserve some proper velocity in its own motion but its velocity depends on the sole size of the circle.

p 2-48
But if it be maintained that chance is the explanation why a star in a larger circle is moved more swiftly, he disproves this in two ways.

p 2-48
First of all, because, if this were due to chance, it would not be reasonable to find this in the case of all circles and stars, namely, that a greater size of the circle goes hand in hand with a greater velocity of a star's motion. For that this should happen in one or two cases would not seem impossible, but that it happen in all cases, and be a result of chance is seen to be a fiction — for things that are due to chance do not occur in the same way in all cases, or in the majority of cases, but only in a lesser number.

p 2-49
Secondly, he shows that this cannot be due to chance, on the ground that chance has no place in things that are due to nature; rather, things that happen fortuitously are outside the order of nature. That is why things produced by chance or fortune do not occur in the same way in all cases, as do things due to nature. Therefore, since there is nothing outside nature in the motions of the heavenly bodies, as was had above, it cannot be that the case under discussion is due to chance. Thus it is plainly not true that the circle and the star are moved together, and with equal velocity.

p 2-49
It is possible to offer yet another reason to disprove this assertion: for, as Alexander says, it would follow that one or other of the motions would be superfluous, which does not occur in things from nature.

p 2-49
399. Then at [†300] he investigates the third possibility.

First he shows that it is not possible for the star to be moved and the circle to be at rest, and says that, if one should hold the circles to remain in the same position and the stars to move, the same unreasonable things as before will follow. For it will turn out that the star which is "outside" is moved more swiftly. And if this refers to the fixed stars, a star will be said to be "outside" if it is outside the poles and nearer the equinoxial circle [the equator]; if it refers to planets, a star will be said to be "outside" if it is in a containing circle (for the contained is within the container). In either case, the circle which is outside is greater. Consequently, it will follow that the velocities of the stars will be proportioned to the size of the circles — which has already been disproved.

p 2-49
400. Secondly, at [†301], he verifies the last member of the division and says that, since it is not reasonable for both, i.e., the star and the circle, to be moved or for the star alone to be moved, what remains is that the "circles," i.e., the spheres, are moved, and the stars are at rest with respect to themselves, in the sense of not being moved per se, but with the motion of the spheres in which they are fixed. They will be moved together not as two things with different natures (as happens in the case of a nail embedded in a wooden wheel) but as two things of the same nature. It is as though the stars were the more noble part of the sphere, in which light and active power are concentrated.

p 2-49
Now this is a reasonable supposition, since, one it is assumed, nothing unreasonable follows.

For in the first place it is not unreasonable for the greater circle to have a greater velocity, so long as the circles in question are related to the same center.

If "center" be here taken in its proper sense, this must be referred to the various circles of the planets, which, according to Aristotle, are all about the same center, namely, the earth — for the astronomers of his time did not posit eccentrics, nor epicycles. But this could not be applied to the various circles described by the fixed stars in their motion, for not all those circles have the same center. However, if we desire to apply it to the fixed stars, then we must take the word "center" as meaning the "pole" [i.e., axis] since, just as the center is to a circle on a plane surface, so is the pole [axis] in a way to a circle on a spherical surface.

Now since various circles can be designated on the same sphere with respect to the same poles, a circle is smaller and its motion slower according to its nearness to the pole, just as, among circles set one under the other, that circle is less and slower which is nearer the center. Hence the center and the pole are indivisible and completely immovable.

The reason why he says this is reasonable is that, in other bodies also, which are moved with rectilinear motion, the greater the body, the more rapidly is it moved by its own natural motion — as a larger portion of earth is moved downward with greater speed (while the contrary happens in compulsory motion, in which the motion is slower according as the body is larger). Hence, too, in bodies that are moved with a circular motion, since their motion is natural, it is reasonable that the larger the circle, the more rapidly it be moved.

That the motion of a larger circle is swifter is plain from the fact that, if two lines be drawn from the center through all the circles to the last, the portion cut off [i.e., the arc] by those two lines will be greater in a larger circle and less in a smaller. And the same holds if two circular [longitudinal] lines be drawn from the pole through all the circles to the largest of them [at the equator]. When, therefore, one of the said circular lines shall as a whole reach the place previously occupied by the other, it is plain that in the greater circle it will traverse a greater distance in the same time, which is to be moved more rapidly, as is said in *Physics* VI, namely, to traverse a greater distance in equal time. It will thus be reasonable, therefore, that a greater circle will traverse a greater distance in an equal amount of time, and that thus its motion will be swifter.

401. Secondly, there does not occur the unacceptable consequence that the heaven would be "torn apart," i.e., rent, which we would have to say if the stars are moved and their orbs are at rest — especially since it has been shown that the entire heaven is continuous, in such a way that the lower sphere is wholly in contact with the higher. If, then, the orbs should be at rest and the stars in motion, and assuming that the stars are embedded in the bodies of the spheres, it would follow that the stars by their motion would split or shatter the very substance of the spheres. But if they were moved on the surface of the higher sphere, either the lower sphere would have to be split by the motion of the star, or else there would have to be an intermediate space between the two spheres, depending on the size of the star. Now this space would have to be either empty, or full of some passible body that would be rent, after the manner of air or water, by the passage of the moving body. But both these alternatives are impossible.

All these unacceptable situations are avoided, however, if we suppose the stars not to be moved *per se* but only by the motion of the orbs.

p 2-50

This explanation which has been given fits both the fixed stars and the planets. It can, however, be applied in another way referring to the fixed stars only. Since he had proved that the motion of the larger circle is more rapid on the basis of the portions cut off by the two lines drawn from the center or from the pole, he proves this [i.e., that the stars are carried in their spheres] once more with another argument: Unless the greater circle in the sphere of fixed stars were not in more rapid motion, it would follow that the sphere of the stars would not be a continuous whole, but would be separated into parts — since a star in a smaller circle, if it had a motion equally as swift, would necessarily complete its circuit in less time, for the notion of the equally rapid is that in a lesser time it traverses a lesser distance.

Lecture 12 (Aristotle's Text)

290a7-290a24

[302] Again, since the stars are spherical, as our opponents assert and we may consistently admit, inasmuch as we construct them out of the spherical body, and since the spherical body has two movements proper to itself, namely rolling and spinning, †2 it follows that if the stars have a movement of their own, it will be one of these. But neither is observed. (1) Suppose them to *spin*. They would then stay where they were, and not change their place, as, by observation and general consent, they do. Further, one would expect them all to exhibit the same movement: but the only star which appears to possess this movement is the sun, at sunrise or sunset, and this appearance is due not to the sun itself but to the distance from which we observe it. The visual ray being excessively prolonged becomes weak and wavering. †3 The same reason probably accounts for the apparent twinkling of the fixed stars and the absence of twinkling in the planets. The planets are near, so that the visual ray reaches them in its full vigour, but when it comes to the fixed stars it is quivering because of the distance and its excessive extension; and its tremor produces an appearance of movement in the star: for it makes no difference whether movement is set up in the ray or in the object of vision.

290a25-290a29

(2) On the other hand, it is also clear that the stars do not *roll*. For rolling involves rotation: but the 'face', as it is called, of the moon is always seen. †1 Therefore, since any movement of their own which the stars possessed would presumably be one proper to themselves, and no such movement is observed in them, clearly they have no movement of their own.

Lecture 12 (Aquinas' Commentary)

Lecture 12

That the stars do not move themselves concluded from the motions proper to the spherical shape.

402. Having presented the first argument to show that the stars are moved by the motion of their circles, which argument was based on a comparison of the stars with their circles or orbs, the Philosopher here presents a second argument based on the shape of the stars [†302]. The argument is this: The stars are spherical in shape; hence, if they were to be moved, they would have to be moved with a motion that is proper to a spherical body, which is twofold, namely, "volutation" and "circumgyration." But the stars are moved with neither of these motions. Therefore, they are not moved according to themselves but what appears of their motion is due to their being moved according to the motion of the circles.

403. First, therefore, he proposes that the stars are spherical in shape and this he manifests in two ways. In one way, because everyone else speaks thus, namely, to the effect that the stars are spherical: for which reason it should be accepted as probable. In another way, from an argument taken from what has already been determined. For it has been said that the stars are made out of the nature of the heavenly bodies. Hence we must profess that they have the same shape as the heaven. But it has been shown above that the heaven is spherical in shape. Hence the stars must be spherical in shape.

404. Then he shows the difference between the circular motions proper to spherical bodies. And he says that there are two motions that belong *per se* to a spherical body, i.e., in virtue of its spherical shape, namely, "volutation" and "circumgyration." Now these two motions differ according as the axis and poles upon which the spherical body is understood to be moving are diverse — and these differences are reckoned in relation to us. For if the stellar body is reckoned to be in motion upon two poles, one of which is in the surface facing us and the other in the surface opposite, in such a way that we take the axis as a line passing through the star's depth, then the star is being moved with a motion of "circumgyration." In this motion the stars keep the same face toward us after the manner in which a mill-stone is moved. But if the stellar body is understood to be in motion upon two poles, both of which are taken at some point where it joins the body of its sphere, then the star in its motion will not always keep the same face toward us. In this case the motion will be "volutation." Therefore, because these are the two motions proper to a spherical body, if the stars are moved with motions of their own, they should be moved with one or the other of these.

405. Then he shows that the motion seen in the stars is due to neither of these two motions. First he shows that the motion seen in the stars is not one of circumgyration; and he proves this in two ways. First, because if the stellar bodies were being moved with the motion of circumgyration, then, even though the parts of the star exchanged places as to subject, the star as a whole would have to remain in the same place as to subject, the place being varied only according to notion, as is clear from what was proved in *Physics* VI. For that is the way things turn out for a spherical motion due to its relation to a center and to poles that are stationary. But we cannot admit such a situation in the stars, since the contrary is evident to sense — for we see stars sometimes in the east and sometimes in the west. Likewise, everyone says that the stars do

not remain always in the same place but are transferred from one place to another. Therefore, the motion that appears to be in the stars is not one of circumgyration.

p 2-53

He shows the same thing another way, from the fact that if the motion of circumgyration should befit the stars, it would be reasonable for all to be moved with that kind of motion, since they are all of one nature, namely, the nature of heavenly body as was shown above. But such a motion is not seen in all stars but in the sun alone, and not when it is in just any part of the heaven, but only when it rises and sets. And these appearances are due not to the fact that the sun is circumgyrated but to the increased distance between the sun and our vision — for our vision, since it is so far from the sun, "wavers," i.e., quivers, on account of its feebleness, insofar as it is overwhelmed by the sun's exceeding brightness.

p 2-53

And this may also be why the stars seem to twinkle, namely, because of their being at the greatest distance from us, since they are in the eighth sphere. On the other hand, the planets are not seen to twinkle, because being nearer to us, our vision is powerful enough to reach them in full strength. But when looking at the "stationary," i.e., fixed, stars, our vision quivers as though from being extended to something very far off, due to the distance separating those stars from us. Now it is the quivering that occurs in our vision that makes the stars seem to be in motion, either according to twinkling, as in the case of a fixed star, or according to circumgyration in the case of the sun. For in order that something appear to be in motion, it makes no difference whether it is our vision, or the thing observed, that is in motion. This is plain in the case of those sailing along the coast, where, because they are in motion, it seems to them that the mountains and the land are in motion.

p 2-53

406. With respect to what is said here, one should consider that the Philosopher says here that our vision quivers as greatly extended, when looking at the fixed stars, not because seeing takes place by means of something sent out from the sight — for he disproves this theory in *De Sensu et Sensato* — but because in such a situation it makes no difference whether vision takes place because sight sends something out or because it receives something within it. For our vision strains to see things afar, not only if it should have to emit a visual ray to the distant body, but also if it has to receive a species travelling from the distant body, for the impression from a distant body is weaker and is, accordingly, more difficult to sense. However, Aristotle uses a manner of speaking in this instance as though sight took place by sending something out, because mathematicians so use it in their proofs, and many people speak in such terms. Now, as he himself says in *Topics* II, words are to be used as most people use them.

p 2-53

407. It should also be noted that he calls certain stars "fixed" or "stationary," not because they are not moved at all when their sphere is moved, as are the planets, which are called "wandering," but because, unlike the planets, they always maintain the same relative position to one another and present the same configurations.

p 2-53

Likewise his assertion that the planets do not twinkle, must, as Simplicius says, be understood as applying to the majority of planets — for Mercury twinkles, and hence in Greek it is called *Stilbon,* from "twinkling." The sun, too, seems to twinkle and even circumgyrate. But the twinkling appears due to the fact that our sight cannot properly apprehend the things seen: in the case of the fixed stars this occurs on account of their distance; in the case of the sun on account of its exceeding brilliance. The circumgyration on the other hand is seen due to the fact that the seen object is able to transmute the sight in such a way that, the visual spirit having been turned about, the sun itself seems to turn about. Hence it is that the sun

especially seems to rotate more when it rises and sets, for then our vision can fix itself more on it because its brilliance is not as powerful, on account of earthly vapors. But when it has risen, because of the excess of its brightness the eye cannot fix itself on it long enough to make it appear to rotate, but sees it scintillate.

p 2-54

But Alexander says that the reason why the sun appears to rotate at sunrise and sunset is because one senses its twofold motion, namely, the diurnal and its own proper motion, in comparison to the motionlessness of the earth. But this is not believable, namely, that the motion of the sun, especially that by which it is moved with its own proper motion, should be perceived in so short a space — when it is hardly felt even over many days. Aristotle says also, in the letter of the text, that this rotation appears, not from the sun, but from the distance of our vision.

p 2-54

408. One should know that Plato supposed that the stars are subject to a motion of circumgyration in addition to the motion they undergo in virtue of their orbs. Simplicius tries in various ways to show that this is so. First, because, since the stars are natural bodies, they must have some natural motion; and since they share in the nature of the heaven, they must of themselves be moved with a circular motion, which is circumgyration. Secondly, because the stars, in the opinion of many, are animated bodies and therefore must have self-movement: although they are in some sense parts of their orbs, since they have in themselves their own integrity and their own circumgyration. Thirdly, because, since a spherical figure is most suitable for circular motions and most unsuitable for other motions, it seems that stars are of themselves moved circularly with their own motion of circumgyration. In line with this, Plato proposed that the fixed stars are moved with two motions, namely, with a motion of circumgyration according to themselves, and with the motion of the orb (because they are seen to be moved from east to west). But the wandering stars are, according to him, moved with three motions: namely, with a motion of circumgyration, and with the motion of their own orb, and with the motion of the outermost orb, which is diurnal motion.

p 2-54

Simplicius also says that Aristotle is not here concerned with disproving this position. For he does not show that the stars are not circumgyrated at all, but rather that the motion which is manifest to sense in the stars is not one of circumgyration, since circumgyrated things remain in their entirety in the same place, whereas the stars, so far as the motion observed in them is concerned, do not remain in the same place. And because circumgyration is more clearly apparent in the sun at sunrise and sunset, he therefore shows that what is seen in it of such a motion, is not because of it, but because of a transmutation of our vision.

p 2-54

But since it was Aristotle's intent not to get away from sensible appearances, consequently, since such a circumgyration does not sensibly appear in the stars, he therefore did not assert this motion to exist in the stars, even though he did not directly disprove it. Likewise, he also did not do so because the movements of the heavenly bodies cause the motions of the lower bodies according as the former approach or recede from us — yet there is no effect noticed in lower bodies according to such a circumgyration of the stars, nor do the stars approach or recede from us according to this motion. For this reason, Aristotle is not concerned with attributing this motion to the stars.

p 2-55

409. Then he shows that the stars are not moved with a motion of "volutation." For whatever is revolved must be so turned that the same face is not always turned to the observer. But we see that in one of the stars, namely, in the moon, the same surface always appears to us, namely, that surface which is called the "face," because there appear in it certain distinguishing marks, just as there is in the face of a man a certain

distinguishing according to lineament. From this it is clear that the moon is not moved with a motion of volutation. For the same reason no other stars are, because, since the same nature is in all the stars, the same reason is seen to hold for one and for the others. Thus he concludes: Since it would be reasonable for the stars, if they were moved on their own, to be moved with proper motions, namely, "regyration" and "volutation," and yet, as has been shown, they are not moved with these motions, therefore they are not moved of themselves.

p 2-55

410. It should be noted that the diversity which appears on the surface of the moon is variously explained by different ones. For some say that the cause of this diversity is the interposition of some body between us and the moon, thus preventing us from seeing its full brightness. Hence, in that portion where such bodies are interposed between us and the moon, it appears to be dark because we do not see the brightness of the moon in that part. However, this cannot be, for such an interposed body would not be interposed in the same way between the moon and the sight of a man in any part of the world whatever. Consequently a like disposition would not be observed in the moon from everywhere in the world, just as there is not seen a similar view of a solar eclipse from everywhere in the world, when the moon gets between the sun and the earth. But this does not occur in connection with the aforesaid diversity in the moon — for it is seen in a similar way from all parts of the earth, whether east, west, south, or north.

p 2-55

Others hold that this darkness appearing in the moon is a certain likeness of some body, such as the earth, or the sea, or mountains, which results in the moon after the manner in which a form results in a mirror.

p 2-55

But this too is voided for the same reason. Because if such forms of this sort were mirrored by a reflection of visual rays or visual forms, there would not appear a similar variation from everywhere on earth, any more than a form in a mirror appears according to a same disposition no matter from what angle one looks at it. The reason for this is that an image is reflected back at determined places according to the position of the bodies reflected. Moreover, the proposed explanation would nullify Aristotle's argument, because it could be said that the reason why the same diversity always appears to us in the moon is not because the same surface is always turned toward us, but because whatever the surface, it receives from the aforesaid causes such an appearance when it is turned toward us.

p 2-55

And therefore others say — and this is a better explanation — that such a diversity [on the surface of the moon] is seen in the moon because of the disposition of its substance, and not because of the interposition of some body or because of some reflection. There is a twofold opinion among them. For some say that the forms of effects are in a certain sense in their causes, in such a way, however, that, the higher the cause, the more uniformly the various forms of its effects are in it, whereas the lower the cause, the more distinctly are the forms of its effects in it. Now the heavenly bodies are the cause of the lower bodies, and among the heavenly bodies, the moon has the lowest rank. Therefore, in the moon, according to its lower surface there is contained, so to speak, the diversity of generable bodies as in an exemplar. This was Iamblichus' opinion.

p 2-56

But others say that, although the heavenly bodies are of another nature than the four elements, yet the properties of the elements pre-exist in the heavenly bodies as in their causes — not in the same way as in the elements however, but in a certain more excellent manner. Now among the elements the top rank is held by fire, which has the greatest light, while the lowest in rank is held by earth which has a minimum of light. Consequently, the moon, which is the lowest of the heavenly bodies, is proportionate to earth and is

in some sense similar to it in nature — for which reason it cannot be totally lit up by the sun. Hence, in that portion where it is not perfectly lit up by the sun, there is seen to be a certain darkness. And this darkness always appears according to the same disposition in the moon — something that would not be if the moon were revolving, for then the look of that obscurity would gradually change.

Lecture 13 (Aristotle's Text)

290a30-290b11

[303] There is, further, the absurdity that nature has bestowed upon them no organ appropriate to such movement. For nature leaves nothing to chance, and would not, while caring for animals, overlook things so precious. Indeed, nature seems deliberately to have stripped them of everything which makes self-originated progression possible, and to have removed them as far as possible from things which have organs of movement. This is just why it seems proper that the whole heaven and every star should be spherical. For while of all shapes the sphere is the most convenient for movement in one place, making possible, as it does, the swiftest and most self-contained motion, for forward movement it is the most unsuitable, least of all resembling shapes which are self-moved, in that it has no dependent or projecting part, as a rectilinear figure has, and is in fact as far as possible removed in shape from ambulatory bodies. Since, therefore, the heavens have to move in one place, and the stars are not required to move themselves forward, it is natural that both should be spherical—a shape which best suits the movement of the one and the immobility of the other.

Lecture 13 (Aquinas' Commentary)

p 2-57
Lecture 13

From their shape the stars shown not to move themselves. No sense power in the heavenly bodies.
p 2-57
411. Having presented two arguments to show that the stellar bodies are not moved with a motion of their own but are carried along by the motion of their circles or spheres, the Philosopher now proves the same thing with a third argument [†303], which is based on the shape of the stars.

p 2-57
And he says that if the stars were moved with a forward motion, as though walking through their circles, it

And he says that if the stars were moved with a forward motion, as though walking through their circles, it would seem unreasonable that nature should not equip them with instruments suitable for local motion. For nature does not produce its effects haphazardly especially when it comes to its more noble products. Consequently, it is not unreasonable to suppose that nature would have care for terrestrial animals by equipping them with organs suitable for progressive motion and would neglect bodies as precious as the stars and not equip them with organs suitable for progressive motion. Rather it seems that nature deliberately did not intend the stars to be moved on their own, from the fact that it deprived them of all instruments by which they might move of themselves with progressive movement, and furthermore, because the stars are most removed from the shape of animals having instruments suitable to progressive motion. For animals of this sort, the more perfect they are, the greater variety do they exhibit in their parts — but the stars have everywhere the greatest degree of uniformity, since they are spherical in shape.

p 2-57

412. On this account it seems reasonable for the entire heaven, and for each star, to be spherical. For a spherical shape seems uniquely suitable to circular motion, i.e., a motion in which a spherical body is moved "in itself," i.e., not changing its place as a whole except as to notion, but only as to its parts, as is proved in *Physics* VI. The fact that a body circularly moved is spherical allows it to be moved with the greatest speed, not only because a circular line is the smallest of all the figures that can contain an equal area but also because rectilinear bodies do not have a uniform motion in every part, since they are more fixed wherever they have a flat surface than where they have corners. Hence, since a sphere is nowhere flat but everywhere constitutes a point, i.e., a corner, it is plain that a spherical body moves swiftest with a circular motion. Likewise, it will most perfectly retain its own place, since no part of it ever begins to be except where another was, whereas this does not happen with rectilinear bodies, whose corners jut out further than their surfaces.

p 2-57

However, a spherical shape is least suited for forward motion. Sphericity has nothing in common with the bodies of animals that are capable of self-movement. For there are not depressions or eminences in a sphere as there are in a rectilinear body. But sphericity is most unlike the shape of the bodies of animals which move forward by a certain raising and lowering, for which reason the members of animals are flexible at their joints in order to be suitable for progressive movements.

p 2-57

Since, therefore, it was necessary for the whole heaven, i.e., the sphere thereof, to be moved with circular motion, whereas the stars were not to be moved with a forward motion, it was reasonable for each to be made spherical, namely, both the sphere and the star. For the heaven being spherical makes it suitable for circular motion, and the stars' being spherical makes them unsuited for progressive motion. Consequently, the latter are not moved within the circles, but, while remaining stationary in themselves, are carried along by the motion of the circles.

p 2-58

413. Now, a difficulty can arise here: namely, since the bodies of the spheres are not visible, being transparent, and it could be said that the stars are moved, as it were, in air, why did Aristotle omit to make inquiry on this point?

p 2-58

But it should be said that it is abundantly clear from Aristotle's teachings that in the heaven are not only distinct stellar bodies but also distinct bodily spheres.

p 2-58

First, from the fact that he shows the stars are not being moved on their own by the motion which appears in them.

p 2-58

Secondly, it is clear from an argument he previously gave, namely, that there would be no reason why a star which traverses a greater circle should be moved more swiftly, whereas there is a reason if a motion of the circles is assumed, since it is reasonable for a greater circle by its own motion to be moved more swiftly.

p 2-58

Thirdly, because Aristotle in the beginning of this book proved that there is a body which is moved circularly, while the movement of a star, if it were moved on its own, without its orb, would be progressive and not circular, because it would not be moved while remaining in the same place.

p 2-58

Fourthly, because that space in which the stars would be moved cannot be void, since it is impossible for a void to exist in nature, as was proved in *Physics* IV. But if it were filled with some other body that had nothing in common with the nature of the stars, for example, fire or air, this would be clearly unacceptable for two reasons. First, because it is not fitting for one and the same place to act as a place for generable-corruptible bodies such as fire and air, and for uncorruptible bodies, namely, the stars, since diverse bodies have places that are diverse, each being suited to the natures involved. Secondly, because it is not reasonable that the lower bodies be continuous and the heavenly bodies mutually discontinuous. What remains therefore is that the entire space in which the stars are seen to be moved is filled with a heavenly body which pertains to the very substance of the spheres.

p 2-58

Fifthly, it is clear from the fact that the sun and moon are moved upon circles that mutually intersect. This is plain from the fact that the moon is now north and now south of the circle in which the sun is moved. But it is evident that the intersections of two circles which are called "nodes," or "head and tail," do not occur always in the same points, since they cannot happen unless the moon is in conjunction or in opposition to the sun with respect to one of these nodular points. But if this variation were due solely to the motion of the moon, it would follow that the moon would not be moved circularly but spirally, which is contrary to the nature of the heavenly bodies. Therefore, it is plain that the circle of the moon has a motion of its own. For the same reason, so do the circle of the sun and those of the other stars.

p 2-59

414. Now it should be kept in mind that when Aristotle states it is not reasonable that nature would be solicitous for the animals and neglect so precious bodies, he is not calling stars animals. Because, as Alexander says, it is sensitivity that makes up the animal nature; but in the heavenly bodies, if they are animate, there is not the sensitive power of the soul, nor likewise the nutritive. Wherefore, it is only in an equivocal sense that they are called animals, namely, because they have an intellective soul.

p 2-59

However, in his commentary, Simplicius endeavors to refute this on the ground that if anything honorable is attributed to terrestrial bodies, then with more reason to heavenly bodies. But since sensitivity pertains to the excellence of a body, there seems to be much more reason for heavenly bodies to possess it than terrestrial bodies. Moreover, since heavenly bodies touch one another, it seems unfitting that they should not sense one another. Therefore, he concedes the existence of three senses in heavenly bodies, namely, sight, hearing and touch, but excludes from them the other two more material senses, namely, smell and taste.

415. Let us see, therefore, how much of this is in accord with the judgment of Aristotle, who seems to feel that no part of the soul but the intellective is found in the heavenly bodies. For he says in *Metaphysics* XII that the first mover moves the heaven as an object of desire, not indeed by the desire of sense, but by the desire of intellect. And in *On the Soul* II he says: "All corruptible things that possess reason possess all the rest" — as though this were not the case in incorruptible bodies, in which he believed intellect or reason to exist without the other powers of the soul.

But a statement of his in *On the Soul* III raises a difficulty. He says, "A body cannot have a soul and a discerning intellect without possessing sensation, if it is not stationary," i.e., "if it is produced by generation," i.e., if it is generable and corruptible, as is evident in men and other animals of this sort. He continues: "Nor yet even if it were not produced by generation" — by which he seems to signify that, not even if a body is ungenerated and incorruptible, as are the heavenly bodies, would it have intellect without sensation. In proof of this he adds: "Why should it not have?" — i.e., not have sensation, seeing that it has intellect. "Because it were better so for the body or for the soul," which is as though saying that the lack of sensation is either for the good of the body or for the good of the soul. Then he goes on: "But clearly it would not be better for either — for the absence of sensation will not enable the one [the soul] to think better or the other [the body] to exist better [i.e., more durably]." Then he concludes: "Therefore, no body which is not stationary has soul without sensation." From this he appears to feel that if heavenly bodies are animated with a rational and intellective soul, they also have sensation.

But what he immediately adds goes counter to this interpretation: "But if a body *has* sensation, it must be either simple or mixed. And simple it cannot be; for then it could not have touch, which is indispensable." Since, therefore, the heavenly bodies are simple, they cannot possess sensation.

416. Hence the above-quoted words of Aristotle are explained by Themistius and Averroes in their commentaries in the sense that the expression, "Not even if it were not produced by generation," means: "Not even that which is incorruptible," namely, a heavenly body, "has sensation. And why does it not have sensation?" — as though saying that this is the reason why it does not, namely, "Because it were better so either for the soul or for the body," i.e., if a heavenly body had sensation, it would possess it either for the good of the soul or for the good of the body. "But clearly it is not better for either, for the one [namely, the soul of the heavenly body], will not understand any better" [for its intellect is not the kind that receives from the senses as the human intellect does; rather such an intellect understands after the manner of a separated substance, to which it is immediately continuous in the hierarchy of things]; "nor will the other [namely, the body] exist any better because of this," i.e., it will not be kept in existence through sensation as occurs with the bodies of earthly animals, which are preserved from corruptive things through sense, as is plain from what he had already said [in *On the Soul*].

Now this explanation seems to be more fitting than the other, so far as the efficacy of the argument is concerned. For in order to show that something is not without purpose [*frustra*], it is more necessary to show for what purpose something exists than to show for what purpose something does not exist. Hence, in order for the heaven not to possess sensation, it is enough to show that no advantage would come to it from sensation (and these are the lines according to which the second explanation proceeds). Accordingly, it is not necessary to show that it is better for it not to have sensation (which is the way the first explanation proceeds). For if no advantage would accrue to the heaven from sensation, that is reason enough for not

having sensation. But the conclusion which he draws appears not to fit this understanding, but rather the previous one. For he subsequently concludes, "Therefore no body that is not stationary has soul without sensation." However, it could be said that this conclusion is connected not with what immediately preceded it, but with what he had said above about generable bodies.

p 2-60

Yet, because this interpretation seems somewhat extorted, it seems better to say that the phrase, "Not even what is not produced by generation," should be continued with the preceding statement, so that its meaning would be: Just as a body which is produced by generation does not have an intellective soul without sensation, so also a body that is not produced by generation. But by the phrase, "A body that is not produced by generation," is not meant here the heaven — which is evident from the fact that the heaven remains in the same place as to its entirety, whereas he is here speaking of a body that is not stationary. Therefore, Aristotle seems to be speaking here of certain animated bodies which the Platonists called "demons," and described as being animals possessed of an airy body and eternal in time, as the Platonist Apuleius says in his book, *On the God of Socrates*. They posited such bodies as moving with progressive motion and not stationary in the same place.

p 2-60

417. But anyone who considers the position of the heavenly bodies among natural bodies will see that it does not befit the former to have no sensitive potency. First, because these bodies are not passive, but active. Hence, it is not suitable for their souls, if the bodies are animate, to have sensitive potencies, which are passive.

p 2-60

Secondly, because such bodies, being spherical, are uniform, whereas a body possessing sensitivity must have a variety of organs. For, since sense is a power knowing individual things, a body must have diverse sensitive powers if it is to sense perfectly, by which it may know the different genera of sensible things, different organs being adapted for different senses. Hence, the uniformity of the spherical body conflicts with the disposition of the sensitive soul.

p 2-61

Thirdly, because the heavenly bodies are as though the universal causes of lower effects. Consequently, sensible effects pre-exist in the heavenly bodies not according to a singular, but according to a universal, notion, as being in universal causes. With much more reason, then, do the notions of sensible things exist in the souls of heavenly bodies (if they are animate), not according to a singular notion, which is proper to sense, but according to a universal notion, which belongs to intellect.

p 2-61

418. The heavenly bodies, therefore, if they are animated, have intellect without sense. But just as the intellect of separated substances knows not only universals but also particulars (for they have by one knowing power what we have by several), so, too, the souls of heavenly bodies with their intellect know not only universals but particulars as well. For it is thus in all things, that the perfections which are attributed to the lower through many, a higher thing possesses through one — just as imagination is one power capable of knowing all sensible things, which things sense, however, perceives through different powers.

p 2-61

This also excludes an objection presented by Avicenna who, in his *Metaphysics,* shows that the soul of a heavenly body must have an imagination through which it may perceive the individual positions it assumes in the heaven by its motion, just as our practical intellect does not act according to a universal apprehension

in the heaven by its motion, just as our practical intellect does not act according to a universal apprehension without a particular, as is said in *On the Soul* III. For, according to what has been said, the substance which moves the heaven — whether it be a separated substance or a soul — can perceive individual positions through the intellect without sense, as has been said.

p 2-61

419. The objection of Simplicius, that sensing pertains to the nobility of a lower body, and hence is even more appropriate for a heavenly body, is answered in two ways. First of all, because, since the soul is not for the sake of the body but vice versa, we should not, when considering the potencies of the soul, primarily consider what pertains to the nobility of the body, but what pertains to the notion of soul. Secondly, because that which lower bodies possess, namely, the ability to know sensible things, in an inferior way, that is, through sensation, is possessed by heavenly bodies in a higher way, namely, through an intellective soul united to them.

Lecture 14 (Aristotle's Text)

290b12-291a25

[304] From all this it is clear that the theory that the movement of the stars produces a harmony, i.e. that the sounds they make are concordant, in spite of the grace and originality with which it has been stated, is nevertheless untrue. †2[305] Some thinkers suppose that the motion of bodies of that size must produce a noise, since on our earth the motion of bodies far inferior in size and in speed of movement has that effect. Also, when the sun and the moon, they say, and all the stars, so great in number and in size, are moving with so rapid a motion, how should they not produce a sound immensely great? [306] Starting from this argument and from the observation that their speeds, as measured by their distances, are in the same ratios as musical concordances, they assert that the sound given forth by the circular movement of the stars is a harmony. [307] Since, however, it appears unaccountable that we should not hear this music, [308] they explain this by saying that the sound is in our ears from the very moment of birth and is thus indistinguishable from its contrary silence, since sound and silence are discriminated by mutual contrast. What happens to men, then, is just what happens to coppersmiths, who are so accustomed to the noise of the smithy that it makes no difference to them. [309] But, as we said before, melodious and poetical as the theory is, it cannot be a true account of the facts. There is not only the absurdity of our hearing nothing, the ground of which they try to remove, but also the fact that no effect other than sensitive is produced upon us. Excessive noises, we know, shatter the solid bodies even of inanimate things: the noise of thunder, for instance, splits rocks and the strongest of bodies. But if the moving bodies are so great, and the sound which penetrates to us is proportionate to their size, that sound must needs reach us in an intensity many times that of thunder, and the force of its action must be immense. [310] Indeed the reason why we do not hear, and show in our bodies none of the effects of violent force, is easily given: it is that there is no noise. But not only is the explanation evident; it is also a corroboration of the truth of the views we have advanced. For the very difficulty which made the Pythagoreans say that the motion of the stars produces a concord corroborates our view. [311] Bodies which are themselves in motion, produce noise and friction: but those which are attached or fixed to a moving body, as the parts to a ship, can no more create noise, than a ship on a river moving with the stream. Yet by the same argument one might say it was absurd that on a large vessel the motion of mast and poop should not make a great noise, and the like might be said of the movement of the vessel itself. But sound is caused when a moving body is enclosed in an unmoved body, and cannot be caused by one enclosed in, and continuous with, a moving body which creates no friction. We may say, then, in this matter that if the heavenly bodies moved in a generally diffused mass of air or fire, as every one supposes, their motion would necessarily cause a noise of tremendous strength and such a noise would necessarily reach and shatter us. †1 Since, therefore, this effect is evidently not produced, it follows that none of them can move with the motion either of animate nature or of constraint. †2[312] It is as though nature had foreseen the result, that if their movement were other than it is, nothing on this earth could maintain its character.

291a26-291a28

[313] That the stars are spherical and are not self-moved, has now been explained.

Lecture 14 (Aquinas' Commentary)

Lecture 14

Indirect and direct proof that heavenly bodies do not produce sounds
420. After determining the matter of the motion of the stars, the Philosopher here treats of their sound, sound being an effect of local motion, as is said in *On the Soul* II. Concerning this he does two things:

First he excludes the opinions of others;

Secondly, he determines the truth, at 428.

Regarding the first he does three things:

First he states his intention;

Secondly, he presents the arguments of those who hold the opposite, 421;

Thirdly, he shows how they try to account for a difficulty, at 423.

He says therefore first [†304] that it is clear from what has been said (namely, that the stars are not moved), that if anyone asserts that a certain "harmony," i.e., a harmonious sound, results from their motion as though the sounds of the stars harmonize with one another, such a one would be guilty both of "levity" for making assertions without sufficient reason, and of speaking "superfluously." He says this on the ground that such a sound would not be advantageous to anything, but rather most harmful, as will be clear below. Moreover, the truth is otherwise, according to what has so far been demonstrated.

421. Then at [†305] he presents the argument proposed by the Pythagoreans who held the aforesaid opinion.

First he shows how they proved that the heavenly bodies produce a loud sound by their motion. For there are three things that seem to account for a loud sound made by bodies that are in motion among us, namely, such sounds are due to the size of the bodies that are in motion and to the velocity of their motion and to the number of bodies involved. Now the bodies that exist among us and cause sound have neither the size nor the speed of the sun and moon and other stars. This is evident in part from the fact that the sun and moon circle the whole world every day, and in part from what astronomy brings out about their sizes and the velocity of their motion. This is further confirmed by considering the great number of stars. Consequently there seems to be good reason why the sun and other stars should produce the greatest sounds in their course.

422. Secondly, at [†306] he shows how they proved their sounds would produce a harmony. For it is

evident from what is learned in music that swiftness of motion produces a sharp [high] sound, while slowness produces a grave [low] sound. Now a determinate proportion of high and low according to certain numbers is the cause of harmony in sounds — thus the ratio of 2 to 1 produces the diapason [octave]; the ratio of 3 to 2, or 1 1/2, produces the diapente [fifth] and so on for the others.

p 2-62

Now it has been shown in what has gone before that the larger the circle in which a star is moved the greater is its speed. Such a circle for any given star is reckoned to be larger or smaller depending on its distance from the pole of that sphere in which the fixed stars are moved; while for a planet the size of its circle is reckoned from the center [of the universe]. Hence, according to the proportion of the distances of the stars between themselves, or from the center or the poles, they understood there to be a difference of speeds in the motions of the stars, and consequently, of high or low pitch in their sounds. For they found the elongation or distances to be according to numerical proportions, which produce musical harmonies. Therefore, said the Pythagoreans, the sound of the stars moving in their circuit is harmonious; and this sound they called a "voice," since they held the heavenly bodies to be animated.

p 2-63

423. Then at [†307] he shows how they met a certain difficulty.

p 2-63

First, therefore, he presents the difficulty: Since we have hearing, by which we perceive sound, it does not seem reasonable that we should not hear such a loud voice if it were to proceed from the movement of the stars.

p 2-63

Secondly, at [†308] he shows how they met this difficulty. For they asserted that the reason why we do not hear this voice is that, as soon as we are born, that sound co-exists with us, and therefore it cannot make itself noticeable by its opposite which is silence. For these two things, namely, the voice and silence are judged and discerned the one by the other. Hence, in relation to the sound of the heavenly bodies men are in a situation similar to the people who hammer on bronze and become so accustomed to it that, as it were, they do not perceive the difference between sound and silence, so filled with this sound do their ears become.

p 2-63

424. Thirdly, at [†309] he attacks this explanation, declaring that as we said before, these statements are put forth by the Pythagoreans in an "alluring manner," i.e., according to a certain probable argument that appeals to the ears of men, and "musically," i.e., according to musical arguments, but without getting to the truth. For it is impossible that the reality be as they state. Because if heavenly bodies should make such great sounds, not only is it inconsistent that none of them is heard, which they try to solve, but also inconsistent that lower bodies do not suffer anything from these sounds, even though they do not perceive them. For we know that excessive sounds destroy not only the hearing of animals, but even certain inanimate objects — for example, the sound of thunder rends asunder stones and even harder bodies, such as iron, and buildings and the like. Now this happens not because inanimate bodies are affected by sound in the sense of something perceptible by hearing, but inasmuch as along with the sound, there is produced a violent striking and moving of the air, as the Philosopher says in *On the Soul* II.

p 2-63

Since, therefore, heavenly bodies which are in motion, are of such great size, and since their sound, if produced, must be louder than thunder or any other sound, to a degree proportionate to their size, then

certainly there is every reason that their sound should reach here and that there would be an unbearable power in the violence that it would do to lower bodies.

p 2-63

Their explanation is also plainly insufficient on yet another score, because continued exposure to strong sounds not only takes away the discernment of those sounds, but also that of others — as hammerers of bronze cannot distinguish other very slight sounds. Hence if it is through familiarity with them that we cannot hear the sounds of heavenly bodies, then for the same reason, we should not be able to hear any other sounds.

p 2-63

425. But, as Simplicious says in his Commentary, it seems that the position of Pythagoras can be maintained against the statements of Aristotle. First of all, because it can be said that the sounds of the heavenly bodies are not destructive but rather preservative and vivifying, just as the motion of the heaven is as a certain life for all things existing in nature, as is said in *Physics* VIII.

p 2-64

Then, too, our failure to hear the sounds of heavenly bodies is not due to habit, as is said here, since the Pythagoreans claimed that Pythagoras at times heard this harmony, who, nevertheless, like others, was used to hearing it. But they say this occurred because not all sensible things are proportionate to all the senses, so as to be perceived by them — just as dogs perceive many odors that men cannot detect. In like manner, it can be said that those sounds are not perceptible to human hearing unless one have a sense uplifted and purified as did Pythagoras. It could also be said that Pythagoras heard such sounds not by hearing them but by knowing the proportions from which that harmony is formed.

p 2-64

426. But these explanations do not seem to contain the truth.

First, because we know that although heavenly bodies are the cause of life, and especially the sun, yet its brilliance harms our sight, whose proportion it exceeds. For the same reason a sound coming from the motion of those bodies would on account of its excessive power destroy our hearing.

p 2-64

Secondly, because, just as the intellect can perceive all intelligibles, so sensitivity can perceive all sensibles, for example, sight all that is visible and hearing all that is audible — wherefore in *On the Soul* III it is said that the soul is in a certain way all things according to sense and according to intellect. Hence if there were a hearing power that could not perceive any and every sound, then either the sound or the hearing would have to be called such only equivocally.

p 2-64

Now it can happen that some animal may take pleasure in some kind of sensible thing according to a particular sense that does not delight some other animal according to that sense. For example, man takes pleasure according to the olfactory sense in the odors of roses and lilies, but the other animals do not, for odors of this kind are found agreeable to men for themselves, whereas for other animals odors do not befit them or give them pleasure, except as referring to food; and the same is true for colors. Also it can happen that an animal is unable to distinguish according to some sense the difference of some things because its sense is weak and because the object to be sensed is small. Thus, man, whose sense of smell is weak, cannot discern the difference between certain odors, for example, the odors of animals that are passing by, but dogs do. Yet if the odors were strong, men also could distinguish them. Similarly, some animals according to the sense of sight gaze on the sun's brilliance, which the owl's eyes cannot stand, and avoid as

destructive of its vision.

p 2-64

Hence it would be impossible for such violent sounds to proceed from the movements of the heavenly bodies without being perceived by men or without harming their hearing; unless of course they are called sounds equivocally.

p 2-64

427. And that seems to be the opinion of Simplicius who is seen to dispute Alexander's statement that colors and all such things, should they exist in the heavenly bodies, are present in them as accidents and extraneous additions. Against this he says that to posit accidents and extraneous additions in the stars he considers as most unacceptable, since they have substantial and specific power. For it seemed to him that, because heavenly bodies are the cause of the substantial forms in lower things, no accident could exist in them. And according to this, since sensation is aware only of accidents, it would follow that we cannot sense anything of these bodies. Wherefore he asserts that we neither perceive the stars themselves, nor their size or figures, nor their surpassing beauties, nor their motion — the cause of their sound; all we see is their luster, as it were — just as, for example, the light of the sun is seen around the earth, but the sun itself is not seen.

p 2-65

But this is most expressly false. First of all because Aristotle in *On the Soul* II says: "Neither air nor water is transparent because it is air or water; they are transparent because each of them has contained in it a certain nature which is the same in both and is also found in the eternal and uppermost body." And for the same reason light, which is the actuality of the transparent, possesses the same nature in lower bodies and in heavenly bodies. If, therefore, these inferior bodies possess accidents that can be perceived by sense, then by the same token there exist in the heavenly bodies accidents perceptible to sense.

p 2-65

Furthermore, shape and size are mathematical things, whose notions are independent of that in which they may exist. Therefore, just as the shape and size of lower bodies are perceptible accidents, so too is this the case in heavenly bodies. Moreover, this position would destroy all certitude of the science of astronomy which proceeds from what appears to our senses about heavenly bodies.

p 2-65

Again, how could the motion of the heavenly bodies be their very substance, since motion is something most imperfect? This position would force us to say that, in the sun, shape, light, and motion were one and the same thing, since of one thing there is but one substance. Hence it is plain that it is wholly impossible for what he says to be.

p 2-65

Now there is nothing to prevent heavenly bodies from having a specific power and there being at the same time certain accidents in them — for in the lower bodies there are certain accidental entities, although they have the power to generate things akin to them in kind.

p 2-65

428. Then at [†310] he determines the truth.

First he proposes what he intends;

Secondly, he manifests his proposition, at 429.

p 2-65

He says therefore first [†310] that it is reasonable that we do not hear the sound of heavenly bodies and that lower bodies are seen to suffer no violent effects from them — because they make no sound. Now the very argument that will explain the reason for this, i.e., why we do not hear the sounds of the heavenly bodies and why we suffer no violence from them, will at the same time confirm the truth of the previous statements, namely, to the effect that the stars have no motion of their own. For the problem raised by the Pythagoreans' teaching that a "symphony," i.e., a musical harmony, resulted from the motion of the heavenly bodies, will serve as our argument that the stars are not moved on their own.

p 2-65

429. Then at [†311] he manifests his proposition.

First, with an argument taken from the efficient cause of sound;

Secondly, with one taken from the final cause at 430.

p 2-65

He says therefore first [†311] that whatever bodies among lower bodies are moved according to themselves, these produce a sound to the extent that they produce a "blow," i.e., a percussion, of the air. But bodies that are not moved on their own, but are embedded, or in some way exist, in a locally moving body cannot cause sound, just as people seated in a boat do not cause a sound when the boat is moved, any more than do the parts of the boat firmly attached to the boat, unless because of the weakness of the joint, or when the ship is buffeted. Moreover, we do not perceive that any sound is made by a ship when it is carried along by the current of a river, i.e., when the ship's motion is due entirely to the flow of the water; however, if the motion of the ship is swifter than that of the water, then it will make a sound insofar as it cuts the water.

p 2-66

Yet according to the very arguments by which the Pythagoreans asserted the heavenly bodies to make a sound, someone could say that it is inconsistent with this that the "tree," i.e., the mast, of a ship, and the poop, while being so large, make no sound, or that the ship itself makes no sound when it is carried along by the current. We must, of course, understand that he is excluding the sound due to cutting the water, but not the sound, if any, due to the air being cut by the part of the ship above water. Such a sound is heard especially when the air resists in gusts of wind. But whatever is moved locally on its own — and not in some body which is carried along — without causing any percussion, cannot make a sound.

p 2-66

It must be said, therefore, that if the bodies of the stars were moved by themselves, whether in a great body of air, or whether we understand air as diffused through the whole universe, or whether in a great body of fire, as all those say who assign the highest place in bodies to fire, then the stars in their motion would have to make a sound greater than any natural sound. If that were so, it would follow that that sound would reach us here, and not only would it be heard by us, but it would corrupt the bodies which exist here. But because we do not see this happen, it follows that none of the stars is moved on its own, neither by a violent motion, nor by a motion proceeding from its soul. For the stars could not be moved on their own without dividing either the celestial spheres or some intermediate bodies. Now the spheres are moved on their own, yet they do not divide any body — hence no sound results from their movement.

p 2-66

It is clear that, by what he says here, the Philosopher excludes the imagining of those holding that the stars

are not moved in the spheres but in certain intermediate bodies, such as air or fire or something of that sort.

p 2-66

430. Then at [†312] he shows the same thing from the final cause. For nature has endowed the stars with no motion of their own, and consequently with no sounds, as though foreseeing that unless the stars' motion should be such that they would not move of themselves, there would follow the undesirable consequence that nothing among lower things would be "constant in itself," i.e., preserved for a certain space of time in its being.

p 2-66

One is given to understand by this, as Alexander notes, that Aristotle here feels that God exercises a providence over the things here below; for providence cannot be attributed to nature as it is a certain power in bodies, but only as it refers to a mind establishing nature.

p 2-66

In summing up he concludes [†313] that we have said that the stars are spherical in shape and that they are not moved on their own.

Lecture 15 (Aristotle's Text)

291a29-291b10

[314] With their order—I mean the position of each, as involving the priority of some and the posteriority of others, and their respective distances from the extremity—with this astronomy may be left to deal, since the astronomical discussion is adequate. †3[315] This discussion shows that the movements of the several stars depend, as regards the varieties of speed which they exhibit, on the distance of each from the extremity. It is established that the outermost revolution of the heavens is a simple movement and the swiftest of all, and that the movement of all other bodies is composite and relatively slow, for the reason that each is moving on its own circle with the reverse motion to that of the heavens. This at once leads us to expect that the body which is nearest to that first simple revolution should take the longest time to complete its circle, and that which is farthest from it the shortest, the others taking a longer time the nearer they are and a shorter time the farther away they are. For it is the nearest body which is most strongly influenced, and the most remote, by reason of its distance, which is least affected, the influence on the intermediate bodies varying, as the mathematicians show, with their distance. †1

Lecture 15 (Aquinas' Commentary)

Lecture 15

Swiftness and slowness in the motion of the planets proportionate to their distance from the first sphere and the earth

431. After deciding about the nature and motion of the stars, the Philosopher here determines their order and position, and especially with respect to the planets — for with respect to the fixed stars it is plain that all are situated in the outermost sphere. Concerning this he does two things:

First he shows that in this matter the natural philosopher should take the mathematician's suppositions;

Secondly, he shows what pertains strictly to the natural philosopher to consider in this matter, at 432.

He says therefore [†314] that in regard to the coordination of the stars, namely, as to how each is arranged, in such a way that some are "prior" and some "posterior," i.e., higher and lower, and how they are related as to "elongations," i.e., as to how far one is distant from another, must be considered from what is stated in astronomy where these particular aspects are sufficiently determined. For these matters cannot be derived from the principles of natural philosophy, but from mathematical principles, i.e., from the proportions existing between magnitudes.

Now Anaximander is said to have been the first to find out the notions of the magnitudes of the stars, and of their distances one from the other and from the earth; while it is to the first Pythagoreans that credit is given for grasping the order of position of the planets, although these matters were given more careful and more perfect consideration by Hipparchus and Ptolemy.

432. Then at [†315] he shows what belongs to the natural philosopher to consider on these points, namely, the swiftness and slowness of their motions. He says, therefore, that it is reasonable for the motions of any stars to be slower and faster depending on their proportionate distance from the first sphere and from the earth.

For we suppose as sensibly evident that the outermost revolution of the heaven is "simple," i.e., not composed of several motions, because no irregularity appears in it; moreover, it is the swiftest of all, inasmuch as, in the briefest time, namely, in the course of one day it makes the circuit of the largest circle that encompasses the whole. But the circlings of the planets are both slower and plural, not only because the motions of the different planets are each different, but also because the motion of each planet is a composite of various motions. For each of the planets, as regards its peculiar motion in its own circle, has a movement contrary to the movement of the first heaven — here contrariety is taken in a wide sense, for, strictly speaking, contrariety does not exist among circular motions, as has been said in Book I — in the sense that the motion of the first heaven is from east to west, whereas the movements of the planets in their own circles are from west to east. Hence it is reasonable that the planet nearest to the simple and first revolution, against which it is moving in its own circle, should consume the most time in traversing its own circle — thus Saturn takes 30 [actually 29] years to traverse its orbit.

p 2-67

On the other hand, the planet most distant from the outermost sphere, namely, the moon, traverses its orbit in the least time, namely, in the space of one month or even less. Among the other planets, that nearer to the outermost sphere always traverses its circle in a greater time — Jupiter in 12 years, Mars in two, Venus, Mercury and the Sun in a year, more or less. Thus the farther they are from the outermost sphere, the less time is required for traversing their orbit, the reason being that the first sphere most greatly dominates the planet closest to it, thus making its contrary motion slower, but dominates least the planet farthest away, because of its distance — hence the contrary motion is swifter in it, i.e., in the moon.

p 2-68

The intermediate planets behave according to the proportion of the distance, as the mathematicians show, in such a way, namely, that the higher planets move more slowly in their proper motions. But with respect to the motion whereby they are moved with the motion of the first mobile body, the higher they are, the swifter they are, as has been shown above.

p 2-68

433. However, from what Aristotle says here, it seems that violence exists among the heavenly bodies, namely, if the motion of the planets nearer to the outermost sphere is slowed up by the greater influence exerted upon it by the motion of the first sphere on account of being near it. Now if there is any violence present, it follows that these motions would not last forever as Aristotle wishes — for nothing violent can be eternal, as was mentioned above.

p 2-68

To this Alexander responds that although the domination of the outermost sphere does indeed produce a necessary slowing down in the nearer planet, yet not in a violent manner. For those heavenly motions are controlled by intellect and will. But in motions subject to will that is not violent which is in conformity with the will, even though there be an element of necessity involved. Now the aim of the will of the one moving the highest planet is to move its mobile body in accord with the motion of the higher mobile body, to which it desires to be likened. Consequently, it does not follow that the slowness in the motion of the first planet is violent.

p 2-68

434. But this does not wholly solve the difficulty in such a way as to preserve the principles supposed by Aristotle to the effect that a larger body is moved more swiftly by a proper and natural motion. Hence if that motion whereby a planet is moved in its own circle is proper and natural to it, the consequence is that the sphere of a higher planet, since it is larger, will be moved more swiftly according to its own motion.

p 2-68

Then, too, it seems that a strange order is being preserved if a body which is farther from the immobile earth, but nearer to the most rapid motion of the first mobile, should move slower in its own motion.

p 2-68

435. Hence, others said that in the heaven there is but one motion, namely, the one whereby the entire heaven is revolved from east to west by the motion of the first mobile: and with respect to this motion the higher body has the swifter motion not only according to the size of the circle but also according to the brevity of time, the result being that a higher sphere will traverse a greater circle in less time. Hence a lower star fails to return to the same point according to time, but not because it moves with a motion contrary to the first motion. This explanation saves the teaching that since the higher planet fails only by a little to match the first motion, whereas a lower planet fails more, the higher planet is swifter and the lower planet

slower.

p 2-68

436. Indeed that is the situation if, as Ptolemy says, the motion of the planets takes place on circles equidistant from the equinoxial circle [equator] and upon the same poles. Yet the opposite is apparent, since the planets at one time decline to the north and at another time to the south. Hence, it seems that the failure to keep up with the first motion should be explained in terms of another motion of the planets, by which they are moved from west to east, rather than in terms of a sole failure to keep pace with the first motion, a failure that makes a higher planet seem to be moved more slowly.

p 2-69

437. But Alexander assigns another cause to this besides the one which Aristotle assigns from the dominance of the first motion. For he says that a higher planet requires more time to traverse its circle, not because its motion is slower, but because the distance is greater. For a motion that requires more time can be swifter or as swift as another, if the excess in distance traversed is greater or equal to the excess of time.

p 2-69

But this does not appear in the planets. For since Saturn traverses its circle in 30 years, while the moon traverses its circle in approximately one month, the ratio of the size of Saturn's sphere to that of the moon would have to be according to the ratio of the aforesaid times. But that is not observed in this case, nor in the other planets.

p 2-69

438. Hence it seems that a different explanation should be given, namely, that we must consider two natures in the universe: first, the nature of eternal permanence which is above all in the separated substances, and secondly, generable and corruptible nature which is present in lower bodies. Now heavenly bodies, being intermediate, share somewhat in both, according to two motions. For the first motion, which is the diurnal, is the cause of eternal duration in things; but the second motion, which is in the oblique [i.e., zodiacal] circle from west to east, is the cause of generation and corruption and of other changes, as is plain from the words of the Philosopher in *On Generation* II.

p 2-69

According to this, the first mobile, as being at once the most noble and the nearest to the separated substances in the order of nature, has only the first motion, which pertains to the nature of uniformity. But the other heavenly bodies, to the extent that they depart from the unchangeable substances and approach generable and corruptible substances, share somewhat in the other motion, which pertains to the nature of difformity, and to a lesser extent, according as the body is higher and more noble. According to this, then, the higher planet, namely, Saturn has the least portion of the second motion on account of the nobility of its nature; consequently this motion in Saturn is slower. But the moon, on account of the closeness of its nature to generable and corruptible bodies, shares the most in the second motion, which in it is most swift. The intermediate planets behave in an intermediate way: for Jupiter, which is immediately under Saturn traverses its circle with its own motion in about 12 years; Mars in about two years; the Sun, Venus and Mercury take nearly uniformly one year.

p 2-69

439. Nor does the proportion of speed need to be according to the proportion of the distances, because the heavenly motions are not only natural, but also voluntary and for a desired end. And therefore, insofar as these motions are natural, the general rule is that the higher planets are slower of motion; but insofar as their motions are voluntary, the proportion of their speed varies in a particular case, not according to distance, but according to what is better. Hence, because the motions of Venus and Mercury are, as it were

distance, but according to what is better. Hence, because the motions of Venus and Mercury are, as it were,
bound to the motion of the Sun, as serving the Sun in producing its effects, they are moved as though
uniformly with the Sun.

p 2-70

440. Thus Aristotle's statement that the supreme sphere exercises more influence on the highest planet and
less on a remote one, is not to be understood in the sense of a compulsory force, but in the sense of a
natural impression insofar, namely, as the nature of a higher thing is participated in more by something
closer to it than by something farther away from it.

p 2-70

Thus are the principles of Aristotle preserved. For although both motions are natural to a planet, namely,
the diurnal motion and that in its own circle, nevertheless the former is natural to it according to what is
more noble in its nature. Therefore, it is only with respect to that motion that Aristotle's principle is saved,
to the effect that a larger body is moved more swiftly. Likewise in man, who has a sensitive and an
intellective nature, we say that the more a man is noble, the more he has of the motion of the nobler nature,
namely, the intellective, and the less of the motion of the less noble, namely, the sensitive.

Lecture 16 (Aristotle's Text)

291b11-291b23

[316] With regard to the shape of each star, the most reasonable view is that they are spherical. It has been
shown †2 that it is not in their nature to move themselves, and, since nature is no wanton or random
creator, clearly she will have given things which possess no movement a shape particularly unadapted to
movement. Such a shape is the sphere, since it possesses no instrument of movement. Clearly then their
mass will have the form of a sphere. †3[317] Again, what holds of one holds of all, and the evidence of our
eyes shows us that the moon is spherical. For how else should the moon as it waxes and wanes show for
the most part a crescent-shaped or gibbous figure, and only at one moment a half-moon? And astronomical
arguments †1 give further confirmation; for no other hypothesis accounts for the crescent shape of the sun's
eclipses. One, then, of the heavenly bodies being spherical, clearly the rest will be spherical also.

Lecture 16 (Aquinas' Commentary)

p 2-71

Lecture 16

By reason, and by what sensibly appears, the stars are proved to be spherical in shape.

p 2-71

441. After determining the nature, motion, and position of the stars, the Philosopher here determines about their shape. Concerning this he does two things:

First he shows by reason that the stars are spherical in shape;

Secondly, by what is apparent to sense, at 445.

p 2-71

442. He says therefore first [†316], that someone can reasonably suppose that the figure of each star is spherical not only on the ground that they are of the nature of the heaven, as he proved above, but also because it has been shown above that the stars are not apt to be moved of themselves but are moved by the movements of their circles or spheres. Now nature does not do anything irrational or to no purpose, since the whole activity of nature is coordinated by an intellect acting for an end. Hence, it is plain that to the immovable stars, i.e., to those that are not moved on their own, this intellect gave a figure that is in no way suitable for progressive motion. Such a shape is, as he said above, the spherical, for the reason that it possesses no organ to serve for progressive motion. Yet, such a figure is most suitable for that type of circular motion in which the moved thing in its wholeness does not change its place. Thus it is plain that the stars, according to the mass of their magnitude, are spherical in figure.

p 2-71

443. But this proof does not seem to be appropriate. For Aristotle proved above that the stars are not moved on their own, on the ground that they are spherical in shape — hence, when he now proves that they are spherical in shape on the ground that they cannot be moved on their own, he seems to be arguing in circles.

p 2-71

Alexander's answer to this is that nothing inappropriate follows from this — for Aristotle proved that the stars are not moved on their own, not only because they are spherical in shape but also through certain other middle terms. Likewise, he shows that the stars are spherical in shape through certain other middles and not only because they are of themselves immobile.

p 2-71

444. Simplicius, however, argues against this that the charge of circular demonstration is not removed by the fact that both conclusions are shown by several middles.

p 2-71

But it should be stated that, although the notion of a circular demonstration is not thereby removed, yet there is removed the unacceptable situation arising from circular demonstration, namely, that it shows nothing. For the only way to manifest something is to use what is better known — and of course the same thing cannot be both better known and less known. However, when both conclusions are manifested by other middles, then one can be taken as manifestive of the other, in order to show the convertibility of the conclusions.

p 2-71

445. Then at [†317] he presents another argument for the same, based on what is sensibly apparent, and he supposes that as one star is, so all the others are. There is shown then, by one of them, namely, the moon

supposes that as one star is, so all the others are. There is shown then, by one of them, namely, the moon, from the things apparent to sense, that it is spherical in shape. This he shows in two ways.

p 2-72

First from what is generally considered by all, namely, from the shapes the moon goes through in waxing and waning. For he says that unless the moon were spherical in shape, then, as it waxes and wanes, it would not appear most of the time as having the shape of a crescent or scimitar, or *amphicurtos* [gibbous], or also "dichotomous."

p 2-72

Some explain that the moon is said to be "dichotomous" when it is full, because it is then that it divides the month in half — for "dichotomous" refers to cutting in two. But this explanation conflicts with something that Aristotle will say later, namely, that we see the moon, when it is dichotomous, entering Mars and hiding it according to its dark part, but leaving according to its bright and shining part. From this it is clear that the moon is called "dichotomous" when its surface which is facing us is divided into two parts such that half is dark and half bright. This is also the meaning given to this word in Ptolemy's *Synthesis* translated from the Greek.

p 2-72

446. It is worthy of note that Aristotle makes no mention here of the shape which the moon has at the beginning or end of its waxing or waning, but only of the shape it has while it is waxing or waning. For, since the moon is spherical in shape, one of its hemispheres is always being illuminated by the sun and the other remains dark. When, therefore, the moon is in conjunction with the sun, its whole upper hemisphere, which is directly regarded by the sun, is illuminated by the sun, so that its lower hemisphere remains dark. It is then that the moon is seen by us as darkened and obscured. But as the moon gradually gets away from the sun, that part of its upper hemisphere which is farther from the sun ceases to be illuminated, and the lower hemisphere begins to be illuminated according to the same amount. At that time the moon appears "crescent-shaped," i.e., arc-shaped.

p 2-72

This goes on until it is a quadrant, i.e., a quarter circle, distant from the sun, and then its surface toward us is seen with one half dark and one half illuminated, and this makes it "dichotomous." After that, as the moon moves to opposition with the sun, more and more of its lower hemisphere begins to be illumined by the sun, and then it is called *amphicurtos* [gibbous] until it is in opposition with the sun. For at this time its entire lower hemisphere is illuminated by the sun and it is called "full." After that, it begins gradually to wane little by little until it is a quadrant distant, at which time it is called "dichotomous," as though half of it is bright. This brightness afterwards, when it diminishes below half, becomes crescent-shaped, until conjunction with the sun.

p 2-72

Thus it is plain that as it waxes it is frequently or "mostly" arc-shaped or crescent-shaped, or gibbous; it is dichotomous just once as it is waxing and once in waning, namely, when it is distant from the sun by a quarter of a circle.

p 2-72

447. Now all this would not happen if the moon were not spherical in shape. For it is plain that if its surface turned toward us were totally flat, it would begin to be illumined by the sun all at once, and also to get dark, instead of successively by a continuing increase and decrease. This shows that it has a spherical bulge by which its brightness or darkness comes to be increased little by little — which could not happen if it were any shape but spherical.

448. Secondly, he shows the same thing from astronomical observations, which reveal that the eclipses of the sun are "crescent-shaped," i.e., arcuate. For the sun begins to be obscured according to the figure of an arc, by the interposition of the moon between us and the sun. But this would not occur unless the moon were spherical, for spherical bodies cut each other according to arc-shaped sections, as is proved by mathematicians.

Therefore, if the situation is such with respect to one star, namely, the moon, it follows that all the other stars are also spherical in shape. This, of course, is based on all the stars' being of the same nature.

449. However, Averroes, in his Commentary, says that they are of the same specific nature, in such a way that all the stars are as individuals of the same species. Now this is plainly false. First, because if they were all of the same species, they would have the same specific operations and the same effects, as is evident in all natural things of the same species.

Secondly, because, since the movements of the heavenly bodies are natural, it would follow that all the heavenly bodies would have uniform motions; but this is not true either of the planets in relation to one another, or in relation to the fixed stars.

Thirdly, because such a thing conflicts with the perfection of heavenly bodies. For in Book I Aristotle proved that the universe is perfect on the ground that it is one — for it is one in one species. From this fact one sees that it consists of the total matter of its species. Hence this also pertains to the perfection of the heavenly bodies, namely, that there be only one in one species. For we observe in the case of the lower bodies that there are many individuals of one species, on account of some lack of power or because one individual cannot exist forever — hence the species must be preserved by means of the succession of individuals in the same species. It is also because one individual is not sufficient for the perfect operation of the species — as is especially evident among men, one of whom is aided by another in his operation. Moreover, the multiplication of species, since it is formal, pertains more to the perfection of the universe than does the multiplication of individuals, which is material.

It is plain, too, that the reason which Averroes gives is absurd. For he says that if heavenly bodies were diverse species of one genus it would follow that the heavenly bodies would be material. However, this would much more follow if we posited, as he desires, the diverse heavenly bodies to be diverse individuals of the same species, because multiplication of individuals in one species is made through the division of matter. However, matter is not to be wholly excluded from the heavenly bodies. For it does not follow, even if the heavenly bodies have matter, that they are generable and corruptible, as was had in Book I.

Consequently, it must be said that the heavenly bodies are one in nature according to genus but of diverse natures according to species. Now their spherical shape, as well as their circular motion, follows in them upon the nature of the genus.

Lecture 17 (Aristotle's Text)

291b24-291b28

[318] There are two difficulties, which may very reasonably here be raised, of which we must now attempt to state the probable solution: †2 for we regard the zeal of one whose thirst after philosophy leads him to accept even slight indications where it is very difficult to see one's way, as a proof rather of modesty than of over-confidence.

291b29-292a9

[319] Of many such problems one of the strangest is the problem why we find the greatest number of movements in the intermediate bodies, and not, rather, in each successive body a variety of movement proportionate to its distance from the primary motion. For we should expect, since the primary body shows one motion only, that the body which is nearest to it should move with the fewest movements, say two, and the one next after that with three, or some similar arrangement. But the opposite is the case. The movements of the sun and moon are fewer than those of some of the planets. Yet these planets are farther from the centre and thus nearer to the primary body than they, [320] as observation has itself revealed. For we have seen the moon, half-full, pass beneath the planet Mars, which vanished on its shadow side and came forth by the bright and shining part. †3[321] Similar accounts of other stars are given by the Egyptians and Babylonians, whose observations have been kept for very many years past, and from whom much of our evidence about particular stars is derived. †1

292a10-292a13

[322] A second difficulty which may with equal justice be raised is this. Why is it that the primary motion includes such a multitude of stars that their whole array seems to defy counting, while of the other stars †2 each one is separated off, and in no case do we find two or more attached to the same motion? †3

292a14-292a17

[323] On these questions, I say, it is well that we should seek to increase our understanding, though we have but little to go upon, and are placed at so great a distance from the facts in question. Nevertheless there are certain principles on which if we base our consideration we shall not find this difficulty by any means insoluble.

Lecture 17 (Aquinas' Commentary)

Lecture 17

Two difficulties proposed in connection with what has been determined about the stars.

p 2-74

450. Having determined the question of the stars and shown their nature, motion, order and figure, the Philosopher here solves certain difficulties with respect to what has been said. Concerning this he does two things:

First he presents the questions;

Secondly, he resolves them (L. 18).

p 2-74

As to the first he does three things:

First he excuses himself from presumption in dealing with these difficult questions;

Secondly, he states the questions, at 451;

Thirdly, he points out the difficulty of the questions, at 457.

p 2-74

He says therefore first [†318] that since there are two doubts which anyone could reasonably raise with respect to the stars, we should try to state what we think about them. In so doing we deem it proper that a person's readiness to consider questions of this kind should be attributed rather to respect, i.e., to seemliness or modesty, than to boldness, i.e., presumption, if the one who tackles these doubts welcomes even "small sufficiencies," i.e., reasons that are only slightly sufficient, to discover the truth about these matters concerning which we have very great difficulties, and does this because of what he desires in philosophy, namely, that its principle may stand, i.e., abide firmly.

p 2-74

451. Then at [†319] he presents the two difficulties, the second of which begins at 456.

With regard to the first he does two things:

First he raises the question;

Secondly, he proves something he had presupposed, at 455.

p 2-74

With respect to the first [†319] there are three things to be considered for the understanding of this difficulty. The first of these is that Aristotle is seen to assign to the planets an order different from that of the astronomers of our time. For the earliest astronomers took Saturn as the outermost planet and after it Jupiter; Mars they put third, the Sun fourth, Venus fifth, Mercury sixth, and the Moon seventh. But the astronomers of Plato's and Aristotle's time changed this order as to the Sun, by putting it immediately above the Moon and under Venus and Mercury, which positing Aristotle follows here. Later on, Ptolemy corrected this order of the planets by showing that what the earlier astronomers said was truer, and this is the opinion held by current astronomers.

p 2-74

Secondly, we must keep in mind that certain "anomalies," i.e., irregularities, appear with respect to the

motions of the planets. For the planets seem to be now swifter, now slower, now stationary, now retrogressing. Now this does not seem to be appropriate to heavenly motions, as is evident from what has been said above. Therefore, Plato first proposed this problem to an astronomer of his time, named Eudoxus, who tried to reduce these irregularities to a right order by assigning diverse motions to the planets; a project also undertaken by later astronomers in various ways. Yet it is not necessary that the various suppositions which they hit upon be true — for although these suppositions save the appearances, we are nevertheless not obliged to say that these suppositions are true, because perhaps there is some other way men have not yet grasped by which the things which appear as to the stars are saved. Aristotle nevertheless uses suppositions of this kind, in what regards the quality of the motions, as true.

p 2-75

The third thing that must be considered is that not as many kinds of irregularities appear with respect to the sun and moon as with the other planets: for the sun and moon never appear to be stationary or to undergo retrograde movement as do the other planets, but present only swiftness and slowness. Accordingly, Eudoxus, who at Plato's request first tried to straighten out these irregularities, assigned fewer motions to the sun and moon, which he called the lowest planets, than to the higher ones.

p 2-75

To each of these he assigned four movements, according to the four spheres that revolved the stellar body fixed in the lowest of them. Thus the first sphere moves the stellar body from east to west according to the diurnal motion; the second moves the stellar body in the opposite direction of west to east in the Zodiac — and this is called longitudinal motion; the third sphere moves a stellar body latitudinally, according to which a star is now in a more southerly, now a more northerly, position in the Zodiac. Now he placed the poles of this third sphere in the Zodiac; hence it followed that a major circle, equidistant from the poles, would go through the poles of the Zodiac. From this it seemed to follow that the planets in their latitudinal motion would sometimes reach the very poles of the Zodiac — a situation that never appears. Hence, he posited a fourth sphere that would move a star in an opposite direction to this movement and thus prevent it from ever reaching the poles of the Zodiac. He did not, however, attribute the motion of this fourth sphere to the sun and the moon, but tried to save their appearances by positing only three spheres, proportional to the first three of the other planets, but in such a way that the latitudinal motion of the moon would be greater than the sun's, as is explained in *Metaphysics* XII.

p 2-75

452. With these considerations in mind Aristotle here formulates a question. And he says that while there are many such doubtful matters about the stars, not the least to be wondered at is why the stars farther from the motion of the first sphere are not always moved with a greater number of motions, but rather the intermediate ones are moved with the most, namely, the five planets, which, according to Eudoxus' theory, are moved with four motions. For it seems to be reasonable, if the first sphere is moved with one motion alone, that the star nearest it should be moved with the fewest motions, say two, and the "had," i.e., the next, with three or in some such progression. But now it is the contrary that happens according to Eudoxus' theory, which attributes fewer motions, i.e., only three, to the sun and moon than to some of the wandering stars which he posits as having four motions, although the five planets are farther from the middle [center] of the universe, i.e., from the earth, and closer to the "first body," i.e., the outermost sphere, "than they," i.e., than the sun and moon are, according to the opinion prevalent in Plato's and Aristotle's time.

p 2-75

453. One should further know that, since the suppositions of Eudoxus could not save all the appearances concerning the stars, another astronomer named Callippus, at Aristotle's behest, corrected Eudoxus' suppositions. He added to Mars and Venus and Mercury one sphere and one motion apiece, and to the Sun

and Moon two apiece. Thus to Saturn and Jupiter four motions were now assigned, and to each of the lower planets five. Consequently, the problem raised here by Aristotle would no longer be a problem, because the higher planets, according to this supposition, are now moved with fewer motions than the lower ones. Moreover, to each of the planets he also assigned certain other revolving spheres, as is explained in *Metaphysics* XII.

p 2-76

454. But even this theory could not account for all the appearances about the stars, especially as to their being near and far away from us — which is grasped from the fact that under the same disposition of the air, the planets are seen at one time larger and at another time smaller.

p 2-76

Also it seemed unacceptable that such a multitude of spheres should concur in order to move the planets. It seemed especially superfluous to assign to each planet a sphere to revolve it from east to west with its diurnal motion when this could be caused by the highest sphere revolving the entire heaven with this motion.

p 2-76

Therefore Hipparchus and Ptolemy posited for each planet a single sphere which however was not concentric with the supreme sphere but had a center other than the earth, [i.e., an "eccentric"], in such a way that when the planet is in that portion of the sphere that is farther from us, the body of the planet is seen as smaller and slower moving; but when it is in the opposite region, it is seen as larger and faster. In addition to this, they posited certain small circles which they call "epicycles," which are in motion upon these spheres in such a way that the bodies of the planets are in motion in these epicycles, not as though fixed in such circles, but as though turning through them with a progressive motion.

p 2-76

Thus, in addition to the diurnal motion which they attribute to the entire heaven as due to the motion of the first sphere, they attribute to four planets, namely, Saturn, Jupiter, Mars and Venus, three motions apiece: according to one, the stellar body makes the circuit of its epicycle; according to the second, the center of the epicycle circles the sphere; according to the third, the sphere itself is moved from west to east, every hundred years, the distance of one degree in relation to the motion of the fixed stars. This last motion [the precession of the equinox], is called the motion of the increase [augus], or of the apogee, i.e., of the maximum distance in the eccentric circle.

p 2-76

Now they add to Mercury, in addition to these motions, a fourth, according to which they say that the center of its sphere is moved in a small circle about the center of the world. They also attribute these four to the Moon with the addition of a fifth. For since the circle of the lunar sphere, along which the center of its epicycle is thought to be in motion, declines from the Zodiac to the south and to the north, it is necessary for this circle to intersect the Zodiac at two points called "nodes" or "head and tail." It is only when the moon is present at these points that eclipses of the sun and of the moon can occur; and these do not always occur at the same place on the circle.

p 2-76

This, therefore, caused them to posit a fifth motion in the moon according to which the aforesaid nodes are moved, and this is called the "movement of the head and tail." But they do not say the body of the sun to be moved in any epicycle, but in its own eccentric. Hence, they endowed the sun with just two motions: one, whereby the body of the sun is moved in the eccentric; the other is the motion of apogee which they assign to the sphere of the sun, just as they assign it to the spheres of the other planets.

to the sphere of the sun, just as they assign it to the spheres of the other planets.

p 2-76

Thus it is evident that the problem Aristotle raises, arises also from the above position. For according to this supposition, Mercury and the Moon, the lowest of the planets, have the most motions, whereas the sun, which they place as intermediate, has the fewest, with the remaining planets being in between.

p 2-77

455. Then at [†320] he proves something he had supposed, namely, that the order of the planets is as he had described.

p 2-77

First he proves it in one respect by means of something he had witnessed. And he says that the order of certain of the planets is evident even to sight. For he says that he saw the moon when it was "dichotomous," i.e., with half its face illumined, move in under the star of Mars (for its motion is swifter than Mars'), and the moon according to its blackness, i.e., according to that side which was darkened, concealed Mars, and Mars came out from under the moon passing it according to the bright and shining side of the moon.

p 2-77

Secondly, at [†321] he shows other details about the order of the planets through observations which others have made. And he says that others state themselves to have witnessed similar things concerning the order of the other planets, namely, those who from much time back have observed such things for many years, i.e., the Egyptians and Babylonians, whose study was concerned most with astronomy. From what they say we have many trustworthy statements about each of the stars, based on their observations.

p 2-77

456. Then at [†322] he raises the second difficulty. And he says that with good reason one can wonder why it is that in the first sphere, which is moved by the first motion, there is such a great multitude of stars that their whole order appears to be of the "arithmetical," i.e., of things innumerable (for their number cannot be comprehended by us), whereas in the lower orbs we find one solitary star in each so that two or more of the wandering stars are not seen fixed in one mobile sphere.

p 2-77

Here one should note that in Aristotle's time no motion had yet been discovered in the fixed stars, which Ptolemy posits as moved from west to east upon the poles of the Zodiac one degree every 100 years, so that they complete one full revolution in 36,000 years. Hence the ancients posited the sphere of the fixed stars as the first mobile and as endowed with but one motion, the diurnal. But if we assume a motion of the fixed stars, then this sphere must be moved by two motions: by its own motion, which is the motion of the fixed stars, and by the diurnal motion, which is the motion of the outermost sphere, which is without stars.

p 2-77

457. Then at [†323] he shows the difficulty of these questions. He says that it is good to investigate these doubtful matters, and adds, "for a greater understanding." This text, says Alexander, is defective, and one should understand it as meaning that whatever in these matters is too much for our intelligence one must simply accept, rather than make them a subject of further investigation by ourselves. But it is not Aristotle's custom, in spite of his laconic style, to employ defective language, as Simplicius says. Hence he explains it to the effect that, while it is good to investigate such things, is not a task suited to just anyone but only those of wider understanding. However, Averroes in his Commentary explains it this way: namely, that we should understand that to investigate these matters is both good in itself, and also contributes to man's

growth in understanding — for a person who exercises his mind by trying to understand difficult matters, can better understand others, as is said in *On the Soul* III.

p 2-77

Now the matters to be investigated are difficult, because we can perceive only a little about their causes; and their accidents are further removed from our ken than the bodies themselves are physically distant from us. Yet, if what we shall say enables us to contemplate the truth of these doubtful matters, then what seemed to be doubtful at the beginning of our inquiry will be seen not to be devoid of all explanation.

Lecture 18 (Aristotle's Text)

292a18-292b24

[324] We may object that we have been thinking of the stars as mere bodies, and as units with a serial order indeed but entirely inanimate; but should rather conceive them as enjoying life and action. On this view the facts cease to appear surprising. [325] For it is natural that the best-conditioned of all things should have its good without action, that that which is nearest to it should achieve it by little and simple action, and that which is farther removed by a complexity of actions, [326] just as with men's bodies one is in good condition without exercise at all, another after a short walk, while another requires running and wrestling and hard training, †4[327] and there are yet others who however hard they worked themselves could never secure this good, but only some substitute for it. [328] To succeed often or in many things is difficult. [329] For instance, to throw ten thousand Coan throws with the dice would be impossible, but to throw one or two is comparatively easy. †1[330] In action, again, when *A* has to be done to get *B*, *B* to get *C,* and *C* to get *D,* one step or two present little difficulty, but as the series extends the difficulty grows. [331] We must, then, think of the action of the lower stars as similar to that of animals and plants. For on our earth it is man that has the greatest variety of actions—for there are many goods that man can secure; hence his actions are various †2 and directed to ends beyond them—while the perfectly conditioned has no need of action, since it is itself the end, and action always requires two terms, end and means. The lower animals have less variety of action than man; and plants perhaps have little action and of one kind only. †3 For either they have but one attainable good (as indeed man has), or, if several, each contributes directly to their ultimate good. †4[332] One thing then has and enjoys the ultimate good, other things attain to it, one immediately †1 by few steps, another by many, while yet another does not even attempt to secure it but is satisfied to reach a point not far removed from that consummation. Thus, taking health as the end, there will be one thing that always possesses health, others that attain it, one by reducing flesh, another by running and thus reducing flesh, another by taking steps to enable himself to run, thus further increasing the number of movements, while another cannot attain health itself, but only running or reduction of flesh, so that one or other of these is for such a being the end. †2 For while it is clearly best for any being to attain the real end, yet, if that cannot be, the nearer it is to the best the better will be its state. It is for this reason that the earth moves not at all and the bodies near to it with few movements. For they do not attain the final end, but only come as near to it as their share in the divine principle permits. †3 But the first heaven finds it immediately with a single movement, and the bodies intermediate between the first and last heavens attain it indeed, but at the cost of a multiplicity of movement. †4

Lecture 18 (Aquinas' Commentary)

p 2-78

Lecture 18

The first difficulty, concerning the number of motions of the stars, is solved. The number shown to agree

p 2-78

458. Having proposed the two doubts, the Philosopher here starts to solve them.

First he solves the first question;

Secondly, the second one (L. 19).

p 2-78

As to the first he does two things:

First he shows what ought to be assumed in order to make the first question easier to resolve;

Secondly, he gives the solution, at 459.

p 2-78

He says therefore first [†324] that the reason why the first question is difficult is that we investigate the heavenly bodies as though they were merely an orderly system of bodies without being animated. As a consequence, it seems to us that the order of their motions should be in accord with the order of numbers and according to the position of the bodies. But if the problem at hand is to be settled, we must assume that they have not only some sort of life but also actions — this being proper to things with a rational soul, which act for an end as being masters of their act, and do not act by the sole impulse of nature as do all irrational things. If this is assumed, nothing is seen to be occurring unreasonably if the number of their motions does not proceed according to the position of the bodies. For the diversity and number of the motions is to be taken more in terms of a relation to the final good, which is the principle in all things able to be done [i.e., voluntary actions], as is plain from the words of the Philosopher in *Ethics* VII and *Physics* II.

p 2-78

One should note in this regard that it makes no difference whether we suppose that the heavenly bodies are moved by intellectual substances united to them after the manner of a soul, or by these as separated. But there would be no way to solve this question if they were moved by the sole impulse of nature, as heavy and light bodies are.

p 2-78

459. Then at [235] he presents his solution.

First he states the principles of the solution;

Secondly, he applies them to the question at hand, at 463.

p 2-78

With respect to the first he does two things:

First he states the principles from which we obtain the reason why the higher planets are moved with a number of motions, while the first mobile is moved with only one;

Secondly, he states the principles from which we obtain the reason why the higher planets are moved with a number of motions while the lower planets with fewer, according to the theory of Eudoxus, at 460.

2-78

About the first he does two things:

First he states the principle;

Secondly, he shows it with an example, at 459.

p 2-78

He says therefore first [†325] that in things that can arrive at a perfect good, three degrees are found. The highest degree is that of a thing which is in the best state and does not need any action to acquire perfect good, which is already present to it without any action. The second degree is that of a thing which is nearest to the best in the goodness of its condition, and which, namely, acquires its perfect good by means of one slight action. The third degree belongs to things that are more removed from the best but still acquire their perfect good through several operations.

p 2-79

Then at [†326] he manifests this by an example. And he says that among bodies, that body is seen to be in the best condition which does not require any exercise to maintain its good condition, (which is called *euechia* — "well-being"), in the second grade is a body which attains a good condition by walking just a bit; in the third grade is the body which in order to acquire a good condition needs many forms of exercise such as running, wrestling and boxing.

p 2-79

460. Then at [†327] he states the principles with which to solve the second part of the question, namely, why the lower planets are moved with fewer motions than the higher planets.

p 2-79

First he states the principles;

Secondly, he gives an example, at 461.

As to the first, he does three things:

First he asserts that there is a certain grade below the three already mentioned [†327], and he says that in the fourth degree is found something that, in spite of all its labors, cannot reach the state of attaining its perfect good; yet it can attain a certain other good less than the perfect good. For example, a case of this would be should a body be unable, in spite of all its exercise, perfectly to attain to a good condition, but should through certain exercises attain to a slightly better condition than it previously had.

p 2-79

Secondly, at [†328] he shows that even in this grade there is a certain variety. And he says that it is difficult to "direct," i.e., to proceed rightly, in the case either of many things or many times, for it is more difficult to be correct in many things than in few. "Many" may be taken as referring either to a diversity of things or to a diversity of actions aimed at one objective — thus his statement, "many things," refers to the first; and his statement "many times," refers to the second, especially if the actions are not all at once. From this we understand that something which can achieve a good by means of many things is of greater power than something which cannot employ that many, and as a consequence does not attain the good in question.

p 2-79

Thirdly, at [†329] he gives an example of what he is talking about. And first of all with reference to the phrase, "many things." And he says that it is difficult to throw a "myriad," i.e., 10,000, astragals, which are

phrase, "many things." And he says that it is difficult to throw a "myriad," i.e., 10,000, astragals, which are a type of missile from the island of Chios where there are great astragal-throwers (another text has Coos, another Greek island, where there are also great astragal-throwers), but it is easy to throw one or two of them.

p 2-79

Secondly, he gives an example of his statement, "many times." And he says that whenever it is necessary to do one thing for the sake of another, and this for the sake of another and that for the sake of still another, in such a way, namely, that it is necessary to arrive at one goal by a series of subordinated actions, it is easy to obtain this goal when it can be achieved by one or two actions: for example, if someone buys a horse in order to ride and by riding reaches a certain place. But when a number of actions are required in order to achieve the goal, then it is more difficult. For example, if he should not have ready money with which to buy the horse, but must obtain it by working at some trade, in order to exercise which he must seek the tools required by that trade. It is plain, therefore, that greater power is required, both on the part of the ordering intellect, and on the part of the faculty carrying things out, to reach an objective by many actions, rather than by one or a few.

p 2-80

461. Then at [†331] he gives examples of this principle. And he says that, in view of the foregoing, we must reckon that the action of the stars, so far as the multitude or fewness of their actions is concerned, is akin to the action of animals and plants. For we observe among these lower things that man, possessing perfect power of soul, has many operations, because he is able to attain to many goods — for which reason, he can do many things, not only absolutely, but according to the order of one thing to another, as, for example, when he plans a long series of actions all directed to one end. This does not mean, however, that man is the best thing in the universe — for that which is best in the universe, namely, God, needs no action in order to attain His own appropriate good. For He has no end outside Himself which must be obtained by some action, but He is His own end and the end of all other things. Now action which is for the sake of an end always involves two things, since it is necessary to consider the end for the sake of which something is done and that which is directed to the end, which is done for the sake of this, i.e., of the end.

p 2-80

But animals other than man have fewer actions than man, both because they do not have actions of the intellectual part and because in their exterior actions they have a set pattern predetermined for them by nature — for example, a swallow always builds its nest in the same manner. But plants have perhaps one operation, namely, the nutritive and this "small," i.e., imperfect, in comparison to sentient and intellectual operation.

p 2-80

The explanation of this diversity is that the end which is reached is either some one perfect good, for example, the end which man reaches, namely, beatitude, which he acquires through many operations, or else the many things prerequisite to the perfect good, to some one of which plants and animals attain through one or a few operations. For example, beatitude presupposes, first of all, the preservation of life, then knowledge of sensible things, and finally the apprehension of the universal truth, in which final beatitude lies. This last, man alone obtains, but preservation of life plants attain through the act of the nutritive part, while irrational animals, in addition to this, attain the knowledge of individual things.

p 2-80

462. Therefore, it is plain from all the above that there are five orders of things. For the highest among beings is that which possesses perfect good without acting; the second is that which has perfect good through one or a few actions; the third is that which acquires perfect good through many actions, as does

through one of a few actions, the third is that which acquires perfect good through many actions, as does man. The fourth grade is that which cannot attain perfect good in any way, but acquires something preliminary to it by a few actions or just one, as is true of animals and plants. There remains for that to be the lowest which can acquire none of these, and because of this does not have as a property the participation in any motion.

p 2-80

Thus that a thing entirely lack motion can occur in two ways: in one way, because it is most perfect; in another, because it is most imperfect. Likewise, that a thing have one or a few motions can occur in two ways: in one way, because it is near to the most perfect; in another, because it is near to the most imperfect. But that a thing have many actions or motions is due to its being in a mediate position.

p 2-81

463. Then at [†332] he adapts the aforesaid principles to his purpose. And he says that in the order of things, that which is supreme has and participates in the best without any motion — which indeed happens with the separated substances, which are wholly immobile. Now he says "has" on account of the highest of the causes, which is the most high God, Who is the very essence of goodness; but he says "participates" on account of the lower separated substances, which receive being and goodness from another — for to "participate" is nothing other than to receive from another partially. This, therefore, is the first and supreme order of beings.

p 2-81

He distinguishes a second order and says that it is something which from nearby attains that best thing by a few motions — thus, the highest sphere is said to approach that best thing to the extent that it attains to being the universal cause of bodily things as well as the cause of their permanence. Then he sets down a third degree, saying that something approaches the supreme good through many motions, as do the higher planets, which are also universal causes of effects in the world, and of the permanence and stability of things. After that he sets down a fourth degree, saying that there is something which cannot participate that perfect good but it suffices if it approach it in any way at all.

p 2-81

464. In clarification of these, he adds an example, saying that if we suppose health as the objective of life, we find something as best in this regard, namely, what is always healthy. But in the second degree is found that which is made healthy by the sole process of "thinning," i.e., the withdrawing of what is superfluous. In the third degree is that which indeed acquires health by thinning, but which, in order to be thinned, requires running, and in order to run, must do something else in order to be fit for running — and which thus has a number of motions by which it arrives at the goal of health. In the fourth degree is that which cannot attain health but attains to something of the things that are preliminaries to health — for example, only to running, or even, beyond that, to becoming thin, neither of which is the goal, but rather they have a goal, namely, health, as has been said.

p 2-81

He gives the reason for this, and says that the absolute best for all things is to attain in some way to the end, namely, whether without any motion, or with a few, or with many motions. However, if the end cannot be achieved, then a thing will always be better the closer it gets to the best — for example, should it reach thinning, which is the thing nearest to health, this is better than reaching the stage of running. From this it is also plain that in each one of these orders there can be many grades.

p 2-81

465. And because the earth is in the order of nature the most distant from the highest order of things, it is

therefore absolutely without motion, being incapable as it were of approaching the best under the aspect of being a cause of other things. But the things that are near to the earth and are in the fourth order, are moved with few motions, because they do not attain to the other extreme, which is to be universal causes of the permanence of things; but they are moved to the extent of being able to acquire something of the likeness of the first and most divine principle, under the aspect of being principles of other things. But the first heaven obtains this likeness immediately by a single movement, which pertains to the second degree. But things that are between the first heaven and the outermost bodies, which are in the third order attain to a likeness of the first principle in being able to cause things, but through a number of motions, however.

p 2-82

466. So far, Aristotle has expressed three things: namely, the principle which has and participates in the best — this he has explained to be the "most divine principle." Also he has identified the second order, which attains to the perfect good by a few motions, with the first heaven. He has also assigned the fifth order, which, on account of its imperfections, has no motion, to earth. Now there remains a question about the other two orders; as to what are they to be attributed. For if we attribute the third order to the higher planets on the ground that they attain the perfect and lasting good by means of a number of motions, then the fourth order will seem to be assigned to the sun and moon, which will involve saying that they do not attain the perfect good. But this appears unacceptable, especially since the sun is seen to be the noblest of the planets, and both it and the moon to exercise the greatest influence on lower bodies.

p 2-82

467. And therefore Averroes says in his commentary that the fourth order, which is the order of things that do not attain to perfect good but approach to it by means of a few motions, should be attributed to the three elements, namely, water, air and fire, which indeed are moved by a twofold motion, one being their proper motion according to the nature of lightness or heaviness, and the other being one that they obtain from the heavenly bodies — as fire and the upper region of air are moved circularly according to the motion of the heaven, while the sea flows back and forth according to the motion of the moon. But the third order he attributes to all the planets, which attain perfect good, that is, a universal causality over these lower things by means of a number of motions.

p 2-82

468. But this interpretation leaves Aristotle's doubt unsolved. And therefore, to accord with Aristotle's intention one has to say that the fourth grade should be attributed to the sun and moon which, according to him, are the lowest of the planets. And according to Aristotle's principles, their order in dignity corresponds to the order of their position, on the ground that the higher sphere contains the lower and the container is more noble and more formal than the contained, as is said in *Physics* IV and as will be said later in the section treating of the earth.

p 2-82

According to this, then, it must be understood that the optimum in things is permanence, which, in separated substances, is realized without any motion at all, and whatever of permanence exists in lower things is derived thence. And this explains why the outermost heaven, which is nearest to the separated substances, is by its diurnal motion the cause of the sempiternity and permanence of things; on which account, it ranks highest in resembling the first principle. Further, the higher planets are more a cause of permanence and duration than the lower — for which reason stable things are attributed to Saturn. Hence it is that, according to Ptolemy in his *Quadripartite,* what belongs to Saturn is attributed to the universal loci [events] of times, while what belongs to Jupiter to the annual loci of times, what belongs to the Sun, Mars, Venus and Mercury, to the loci of months, the phases of the moon to daily loci. Likewise the conjunctions of the higher planets cooperate, according to the astronomers, in producing more universal and permanent effects. But the sun and moon, which are according to Aristotle lower planets, have especial influence for causing transmutations in the lower bodies — which indeed is not itself the optimum but something order

causing transmutations in the lower bodies — which indeed is not itself the optimum but something order to the optimum and preliminary to it; for the lower bodies, through the transmutation of generation and corruption, attain to a perpetuity in the species which they are unable to attain in the individual.

p 2-83

469. Simplicius, however, says in his commentary that he does not reckon the order of nobility of the heavenly bodies to be according to their position, but that each of the heavenly bodies, whether more noble or less noble, is put wherever it is best for it to be. That is why the lights of the world, namely, the sun and moon, are according to Aristotle situated nearest the lower bodies, which need their light. However, the prior interpretation seems truer in terms of agreement with natural principles.

p 2-83

470. According to the theories of present-day astronomers, the number of heavenly bodies seems to be disposed suitably enough, although it is not according to the notion which Aristotle here assigns. For, as has been said above and as Aristotle says in *Metaphysics* XII, there has to be among the heavenly motions something which is the cause of the perpetuity and duration of things, and something which pertains to the cause of their change; moreover, in each of these orders there must be something supreme. Therefore, just as in the order of the causality of the permanence of things, after the first motion which moves the whole, the eighth sphere obtains pre-eminence, so too in the order of the causality of change in things, the sphere of the sun holds the top place and is in a certain sense proportionate in this order to the sphere of the fixed stars. Thus, just as the sphere of the fixed stars is pre-eminent in having a multitude of stars which befits the universality of its causality, on account of the diverse kinds of its effects, so too the sphere of the sun superabounds in the magnitude of the solar body and its luminosity for the purpose of efficacy in changing lower bodies. Hence, just as two motions are assigned to the sphere of the fixed stars, namely, its own and that of the superior sphere; so also two motions are assigned to the sun, namely, one which is its own, whereby it is moved in its own circle, and the other by which its sphere is moved according to the motion of the sphere of the fixed stars. Now both spheres are, as it were, served by three inferior spheres. Thus, the sphere of the fixed stars is understood, in its role of causing permanence in things and in causing universal effects, to be served by Saturn, Jupiter and Mars, whence these have motions that are uniform in number, for, as has been said, the number of motions assigned to each of them is three. The sun, in its role of causing changes in things, is understood to be served by the three lower planets. And therefore they are differentiated by degrees in the number of their motions, so that two motions are assigned to the Sun, three to Venus, four to Mercury and five to the Moon.

p 2-83

471. One should likewise know that, since Aristotle here assumes that the earth does not participate in any motion, Alexander fittingly says that it is inanimate. But Simplicius in his commentary says that the earth is animate (for on this point he follows the error of the pagans, who bestowed a divine worship upon the earth). But Aristotle rejects this in *On the Soul* III where he shows that no simple body is animate. And this is plain from an evident sign: for the parts of animals that are more from earth, e.g., bones, are incapable of sensing. If, however, a heavenly body, although simple, should be animate, this would not affect this argument, because a heavenly body is not a subject of contraries as are the simple bodies of the elements.

p 2-83

But Simplicius tries to prove that the earth's body is animated because it endures forever and because some of its parts are animated, forgetting that earth and the other elements are related to animate bodies as matter, whereas celestial body is related to animate bodies as efficient cause. Now efficient cause is nobler than its product and the product nobler than its matter. Hence, even though the heaven has a nobler form than do animate bodies, the elements, however, have a less noble form.

p 2-84

Similarly, he tries to show that animation of earth is not ruled out by the fact that it is not moved. In one way, because plants although animated are not moved with respect to place. But in this he is deceived, because although they are not moved with respect to place, nevertheless they are moved by the motion of augmentation and decrease. In another way, because, since even things that understand [intellectually] are said to live; hence there is nothing to prevent the earth from being animate and living, even though it is not moved according to place — for it may be that it understands. But this, too, is contrary to Aristotle, who says in *On the Soul* II that among the bodies of corruptible things none has intellect without having sense. But that the earth lacks sense is evident from the fact that it is cut and broken up daily. Moreover, since there is the same nature in the whole and in the part and the same motion in each, if the whole earth had an intellective soul, then every separate part of it would have to be animate and intelligent, and furthermore, all compound bodies, in which there is a predominance of earth, would have to be such — which is laughable.

p 2-84

He also adds that, although the earth is stationary, nevertheless it has an operation, namely, "standing," so that, just as movement is an operation of a heavenly body, so the earth's operation is to be stationary or at rest. But in this he is deceived, because to stand or to be at rest is not an operation but a privation of operation or motion. Hence, since there must be in every living body some life operation which appears in the very body and not merely in the soul (for otherwise the soul would be united to that body without purpose), it is plain that earth, in whose body none of the operations of life appears, cannot be animated.

Lecture 19 (Aristotle's Text)

 292b25-293a11

[333] As to the difficulty that into the one primary motion is crowded a vast multitude of stars, while of the other stars each has been separately given special movements of its own, there is in the first place this reason for regarding the arrangement as a natural one. In thinking of the life and moving principle of the several heavens one must regard the first as far superior to the others. [334] Such a superiority would be reasonable. For this single first motion has to move many of the divine bodies, while the numerous other motions move only one each, since each single planet moves with a variety of motions. Thus, then, nature makes matters equal and establishes a certain order, giving to the single motion many bodies and to the single body many motions. [335] And there is a second reason why the other motions have each only one body, in that each of them except the last, i.e. that which contains the one star,†1 is really moving many bodies. For this last sphere moves with many others, to which it is fixed, each sphere being actually a body; so that its movement will be a joint product. Each sphere, in fact, has its particular natural motion, to which the general movement is, as it were, added. But the force of any limited body is only adequate to moving a limited body. †2

 293a12-293a14

[336] The characteristics of the stars which move with a circular motion, in respect of substance and shape, movement and order, have now been sufficiently explained.

Lecture 19 (Aquinas' Commentary)

 p 2-85

Lecture 19

The second difficulty of Lecture 17 is resolved.

 p 2-85

472. Having given a solution to the first problem, he [the Philosopher] here solves the second one, which asks why it is that, whereas there are innumerable stars in the sphere of the first motion, there is but one in each of the other lower spheres.

 p 2-85

473. To this he gives three answers. The first of these is based on the excellence of the first sphere as compared to the others. And he says [†333] that to the question why it is that a multitude of stars is found to be connected with the motion of the first sphere, which is one, while in the other lower spheres of the planets each star has separately its own motions (so that the motions of Saturn are distinct from those of Jupiter, and so on for all the others, whereas all the fixed stars are located according to one motion), to this

the answer must be given that this is reasonable first of all for one reason, namely, because we must understand that the first sphere has a great excellence in comparison to the other spheres, both in point of life, since it has a nobler life as having a nobler soul, and in point of being a principle of each, since, namely, universal causality is truer of the first sphere than of any of the others. Now this excellence can be considered from three facts: first, it [the first sphere] is more immediately ordered to the first mover; secondly, it contains and revolves all the other spheres; and thirdly, it has the simplest and the swiftest motion. It is plain that that which is noblest and more acting in the heavenly bodies is the star, and this is proved by its luminosity. And therefore, it is fitting that the first sphere should abound with a multitude of stars as compared with the other spheres.

p 2-85

474. But if we suppose that the sphere of the fixed stars is not the outermost sphere but that there is another above it, in which there is no star, our proposition is not affected. For the motion of the sphere exists only for the motion of the star, as is said in *Metaphysics* XII — hence, that motion of the supreme sphere that lacks stars is ordained to the movement of the fixed stars, just as, according to the ancient astronomers, each planet has many spheres lacking a star but ordained to the motion of the star fixed in the last of them. Therefore, according to this, so far as the coordination of motion is concerned, that first sphere falls into the same order as the sphere of the fixed stars. For this reason also Aristotle significantly says that there are many stars connected with the first "carrying," but not connected with the first "sphere," since the carryings are determined with respect to the stars, for the sake of carrying which along the spheres are moved, and not with respect to the spheres. This only implies, then, that the motion of the fixed stars will not be wholly simple, as Aristotle supposes, but composed of two motions.

p 2-85

475. The second argument is at [†334] and it is based on the proportion of the multitude of stars to the multitude of motions. And he says that that about which the problem is raised occurs according to reason. For the first carrying along, although it is one, nevertheless many of the heavenly bodies (which he here calls "divine bodies," because of their perpetuity), are moved with it, whereas in the case of the lower carryings, many of them move one body alone, because each of the "wandering" stars, i.e., the planets, is moved with several motions, as has been said above. In this way, then, nature makes a certain equality of proportion between the fixed stars and the planets, and disposes them in good order, in the sense that, to the one first motion it assigns "many bodies," i.e., many stars, but conversely, as to the planets, to "one body," i.e., to one star, it assigns many motions.

p 2-86

And this distribution [by nature] is reasonable. For the planets are as though certain instruments of the supreme sphere, which is as though the principal agent with respect to bodies, insofar as, through the medium of the planets, there are in a certain way transmitted and applied to these lower bodies the manifold powers of the fixed stars. Now an instrument acts insofar as it is moved, while a principal agent acts according to its own form and proper power. Consequently, it is fitting that the supreme sphere abound with a multitude of stars, in which diverse active powers are rooted, while the planets abound in a multitude of motions.

p 2-86

This explanation is valid even in the light of the suppositions of present-day astronomers. For even though the sphere of the fixed stars has two motions, it shares in a minimum way in the second, since it is most slow in it.

p 2-86

476. He gives the third explanation at [†335] and it is based on the multitude of spheres moving each of the

planets, according to the theory of the ancient astronomers. And he says that the reason why in each apparent motion of the planets there is found but one stellar body in motion, is that there are many spherical bodies moving the star, so arranged that those which are "first," i.e., the higher, are movers of that sphere which is at the end and which contains the star. For the star is moved as fixed in the last of many spheres ordered to moving one sphere. Or one can understand that the last of the spheres is in some way connected with the higher spheres and is moved according to their motion.

p 2-86

Now it is evident that each of these spheres is a certain body. Thus, therefore, the common work of all the spheres revolving a given planet belongs "to it," i.e., to the sphere which is supreme in that system and which revolves all the lower — for the motion of the lowest sphere, in which the planet exists, is the proper and natural motion of that planet, while the motions of the higher spheres are, so to speak, added to correct the irregularity that appears in the planet's motion, namely, of swiftness and slowness, retrogression, advancing and standing still. Accordingly, it is plain that, since the higher sphere moves all the lower that are ordered to the motion of the same one planet, then, if in addition to that it had to move several stars, it would be laborious for it — each body's strength being finite in comparison to another body, it having been shown in *Physics* VIII that there is not infinite power in a finite magnitude.

p 2-86

477. It should not be thought that this difficulty would derive from there being weight in the stars or from anything that resists motion, but rather it is because there is required an excess of the mover over the mobile. But there could not be an excess of the superior sphere in power if in the lower things there was together with a multitude of spheres also a multitude of stars, because in the bodies of stars the power of the heavenly bodies most abounds.

p 2-86

It should also be diligently noted that he posits a finite proportion between the movent sphere and the moved bodies on the ground that the movent sphere is a body. This indicates that the separated mover, which is an incorporeal and immaterial substance, does not, according to the intention of Aristotle, finitely exceed the body which is moved by it, but infinitely, as existing outside the whole body of magnitude and not determined by matter. This reveals that Averroes is in error in his commentary when he says that the addition of the first mover over the power of the moved is not infinite except in infinite time. But how, if the power of the separated mover is infinite, it does not move with infinite speed, i.e., in an instant, and how, if the power of a body is finite, that body can endure for an infinite time, has been shown in *Physics* VIII.

p 2-87

It should be noted that this third argument does not apply to the position of the modern astronomers, who do not assign to the planets a number of spheres, one of which moves all the others, as the ancient astronomers did; nevertheless, these latter did hold that the many fixed stars were not moved except by one sphere.

p 2-87

478. In summing up [†336], he says we have stated of the stars, which are moved with a circular motion, what they are according to the substance of their nature and according to their shape. Moreover, we have discussed their motion and order.

Lecture 20 (Aristotle's Text)

293a15-293a16

[337] It remains to speak of the earth, of its position, of the question whether it is at rest or in motion, and of its shape.

293a17-293b16

[338] I. As to its *position* there is some difference of opinion. Most people—all, in fact, who regard the whole heaven as finite—say it lies at the centre. But the Italian philosophers known as Pythagoreans take the contrary view. At the centre, they say, is fire, and the earth is one of the stars, creating night and day by its circular motion about the centre. They further construct another earth in opposition to ours to which they give the name counter-earth. †1[339] In all this they are not seeking for theories and causes to account for observed facts, but rather forcing their observations and trying to accommodate them to certain theories and opinions of their own. [340] But there are many others who would agree that it is wrong to give the earth the central position, looking for confirmation rather to theory than to the facts of observation. [341] Their view is that the most precious place befits the most precious thing: but fire, they say, is more precious than earth, and the limit than the intermediate, and the circumference and the centre are limits. Reasoning on this basis they take the view that it is not earth that lies at the centre of the sphere, but rather fire. [342] The Pythagoreans have a further reason. They hold that the most important part of the world, which is the centre, should be most strictly guarded, and name it, or rather the fire which occupies that place, the 'Guard-house of Zeus', [343] as if the word 'centre' were quite unequivocal, and the centre of the mathematical figure were always the same with that of the thing or the natural centre. But it is better to conceive of the case of the whole heaven as analogous to that of animals, in which the centre of the animal and that of the body are different. For this reason they have no need to be so disturbed about the world, or to call in a guard for its centre: rather let them look for the centre in the other sense and tell us what it is like and where nature has set it. That centre will be something primary and precious; but to the mere position we should give the last place rather than the first. For the middle is what is defined, and what defines it is the limit, and that which contains or limits is more precious than that which is limited, seeing that the latter is the matter and the former the essence of the system.

293b17-293b17

[344] II. As to the position of the earth, then, this is the view which some advance, . . .

Lecture 20 (Aquinas' Commentary)

n2 88

Lecture 20

Opinions of the philosophers as to the site of the earth. Pythagorean theory of fire in the center rejected.
 p 2-88

479. After determining about the heavenly body which is moved circularly, the Philosopher here determines the question of the earth, around which the heaven is moved. But he does not intend to determine here concerning the earth as one of the four elements but as it is the center of heavenly motion, as astronomers deal with it.

 p 2-88

First, therefore, he states his intention;

Secondly, he pursues it, at 480.

 p 2-88

He says, therefore, first [†337] that, since the heaven has been discussed, there remains the earth to be discussed.

 p 2-88

Concerning this, he says there are for him three things to be settled:

First, its situation, namely, where is it positioned;

Secondly, its rest, namely, whether it is one of the things that rest or that are moved;

Thirdly, its shape, namely, whether it has a spherical shape or some other.

 p 2-88

480. Then at [†338] he executes his proposal:

First he pursues the above-mentioned three things according to the opinion of others;

Secondly, according to truth (L. 26).

 p 2-88

Concerning the first he does two things:

First he presents the false opinions of certain ones concerning earth;

Secondly, he presents the false reasons alleged about the true theory concerning the earth's state of rest (L. 22).

 p 2-88

As to the first he does three things:

First he presents others' opinions about the position of the earth;

Secondly, about its rest and motion (L. 21);

Thirdly, about its shape (L. 21).

About the first he does three things:

First he presents others' opinions about the position of earth, 481;

Secondly, he gives their reasons, at 482;

Thirdly, he solves them, at 485.

481. He says therefore first [†338] that not all philosophers have the same opinion about the position of the earth. For whichever ones held that the entire universe is infinite were unable to assign a definite position to the earth, since in the infinite no middle and no boundary can be determined. But a number of those who posited the whole world as finite said that earth is positioned in the middle of the world, as did Anaximander, Anaxagoras, Democritus, Empedocles and Plato. But certain philosophers called "Pythagoreans" who sojourned in the region of Italy said on the contrary that fire is positioned in the middle of the world and that the earth, after the manner of one of the stars, moved circularly around the center of the world, and by its motion makes day and night, according to its different relation to the sun. They also posited another earth — likewise in circular motion about the middle of the world — which they called *antichtona* on account of its contraposition to our earth. But this other earth is not visible to us because in its motion it follows the earth in which we live, in such a way that the entire body of our earth is always interposed between our sights and this other earth.

And although the Pythagoreans said these things according to the face value of their words, they nevertheless understood in their metaphor that fire was in the center since the natural heat produced from the sun and other stars reaches the middle of the world, in a certain way keeping all things in balance and preserving them. But earth they said to be a star because it causes day and night, depending on its relation to the sun. The other earth they called a moon, either because it is interposed to the sun's light as our earth is, as is plain from eclipses, or because it is the boundary facing us of the heavenly bodies, just as the earth is the boundary of the elements.

482. Then at [†339] he presents their reasons. Concerning this he does two things:

First he describes the quality of their reason;

Secondly, he presents the reasons themselves, at 483.

About the first he does two things:

First he describes the kind of reasons the Pythagoreans used [†339] and says that they did not search for reasons and causes in such a way as to apply them to what is sensibly apparent; rather, what was apparent to sense they tried to reduce to, and by a certain violence align with, certain preconceived intelligible reasons and opinions. Now such a method is suitable in things that are man-made, and whose principle is the human intellect; but in things that are the product of divine art, it is necessary, on the contrary, to consider the notions of the works from the works themselves that are seen. Thus, an artisan conforms a house he makes to preconceived plans, but whoever else might see the constructed house would consider the ideas of the work from the sight of the work.

Secondly, at [†340] he shows that it is possible for many others to be moved by these same reasons of the Pythagoreans. And he says that it might seem to many others besides the Pythagoreans that one should not assign the middle region to earth, "if it is their wont to consider things, not as they appear, but according to intelligible reasons." He says this, not as though any of Aristotle's predecessors besides the Pythagoreans posited this, but because it was possible that others would be swayed by these reasons. Hence it is said that after Aristotle's time Archedemus was of this opinion.

483. Then he gives two reasons. The first of these is that they thought that the most honorable "region," i.e., place, should belong to the most honorable body, on the ground that places are proportionate to bodies according to their nature. But it is plain that fire is more honorable than earth, not only because of its brightness, but also on account of its active power and on account of its subtility. It is plain, too, that boundaries are nobler than the intermediates between them, as the terminus is nobler than the thing terminated and a container than the contained. But that which is "extreme," i.e., highest, in the world, and that which is the middle of the world, they thought of as being boundaries. For this reason, they set them down as the noblest places. And therefore, thinking in this wise, they did not place earth in the middle of the sphere of the world, but rather fire, which holds the place of nobility after the heavenly bodies, which are at the boundaries.

484. He gives their second reason at [†342] and says that the Pythagoreans put fire in the middle of the world because, since it is the most principal of the elements it should be most of all preserved — as we more carefully guard precious things. Now the middle place seems to have such a disposition for preserving, as though walled up and strengthened by all the things that surround the middle. That is why the Pythagoreans, speaking metaphorically, called this region which has fire, the "guard-house" or "fortress" of Jupiter. This is the case if we understand that the fire is guarded. But if we understand that fire is the guardian, then, conversely, we must understand that the fire which has this region, i.e., which holds the middle place, is Jupiter's guardhouse in the sense that it has the power of guarding.

485. Then at [†343] he refutes the aforesaid reason and says that in the aforesaid reason the Pythagoreans used the word "middle" as though one called "middle" absolutely, i.e., univocally, both the middle of a magnitude, and the middle of a thing according to nature, i.e., that through which the nature of a thing is preserved — as we see in animals that the middle by which the nature of an animal is preserved, namely, the heart, is not the same as the middle of the body's size, for that would be the umbilicus. A similar viewpoint must be taken with respect to the whole heaven, i.e., to the whole universe. Hence they should not be concerned with the whole universe as though it needs a guardhouse in such a way that such a prison or guardhouse would have to be assigned to the center, which is the middle of magnitude. It is necessary, rather, to seek that which is the middle of nature in the universe, as in the case of an animal, and ask what is its condition according to nature, and which place naturally befits it.

He explains these two things, showing first how the middle of the universe is as corresponding to the heart of an animal. And he says that it is a principle of other bodies, and most honorable among other bodies: and this is the sphere of the fixed stars.

But it is not the middle place but rather the place of the outermost container that belongs to it, for that which

is the magnitudinal middle among the places of the universe is more like an ultimate than like a principle. The reason is that the middle is contained and determined by all the others, while that which is the "end," i.e., the extremity, among bodies according to the order of place, has the nature of a determinant and container. But it is manifest that the container is more honorable than the contained, and the end more honorable than the thing ended — since the contained and the terminated pertain to the notion of matter, but to be a container and that which terminates to the notion of form, which is the substance of the whole consistency of things. Consequently, containing bodies are more formal and contained bodies are more material. And therefore, in the whole universe, just as the earth which is contained by all, being in the middle, is the most material and ignoble among bodies, so the outermost sphere is most formal and most noble, while among the elements fire is above all containing and formal.

p 2-90

Finally, he sums up [†344] and concludes that in regard to the place of earth, some have an opinion such as has been described.

Lecture 21 (Aristotle's Text)

293b18-293b31

[345] . . . and the views advanced concerning its *rest or motion* are similar. For here too there is no general agreement. All who deny that the earth lies at the centre think that it revolves about the centre, †1 and not the earth only but, as we said before, the counter-earth as well. Some of them even consider it possible that there are several bodies so moving, which are invisible to us owing to the interposition of the earth. [346] This, they say, accounts for the fact that eclipses of the moon are more frequent than eclipses of the sun: for in addition to the earth each of these moving bodies can obstruct it. [347] Indeed, as in any case the surface of the earth is not actually a centre but distant from it a full hemisphere, there is no more difficulty, they think, in accounting for the observed facts on their view that we do not dwell at the centre, than on the common view that the earth is in the middle. †2 Even as it is, there is nothing in the observations to suggest that we are removed from the centre by half the diameter of the earth. [348] Others, again, say that the earth, which lies at the centre, is 'rolled', and thus in motion, about the axis of the whole heaven. So it stands written in the *Timaeus*. †3

293b32-294a9

[349] III. There are similar disputes about the *shape* of the earth. Some think it is spherical, others that it is flat and drum-shaped. [350] For evidence they bring the fact that, as the sun rises and sets, the part concealed by the earth shows a straight and not a curved edge, whereas if the earth were spherical the line of section would have to be circular. [351] In this they leave out of account the great distance of the sun from the earth and the great size of the circumference, which, seen from a distance on these apparently small circles appears straight. Such an appearance ought not to make them doubt the circular shape of the earth. [352] But they have another argument. They say that because it is at rest, the earth must necessarily have this shape. For there are many different ways in which the movement or rest of the earth has been conceived.

Lecture 21 (Aquinas' Commentary)

p 2-91
Lecture 21

Different opinions of the motion, rest, and shape of the earth.

p 2-91
486. After presenting opinions about the position of the earth, the Philosopher here presents opinions about its motion and rest.

p 2-91

He presents two opinions; The second of these is at 490.
With respect to the first he does three things:

First he presents the theories;

Secondly, he induces a certain proof thereof, at 488;

Thirdly, he shows how they meet arguments brought against them, at 489.

p 2-91

487. He says therefore first [†345] that just as philosophers have spoken in various ways about the place of the earth, so also about its motion and rest. But those who say that it is not positioned in the middle of world, such as the Pythagoreans, assign to it a circular motion by which it is moved about the middle. Nor do they say that it is just this earth in which we live that is moved but also a certain other one which they called "antichtona," i.e., in counter-position to this earth, as has been said above. This they posited on account of the perfection of the number 10, in order that, since there are 8 heavenly bodies circularly moved, namely, the sphere of the fixed stars and the 7 planets, the number of 10 might be fulfilled by positioning two earths circularly moved.

p 2-91

Now there are some Pythagoreans who claim that there are not only two earths circularly moved, but also several other bodies of earth in motion about the middle. These indeed are imperceptible to us because this earth on which we live is superimposed on the others, in such a way that the others follow its motion. Consequently, the interposition of this earth between out vision and those earths hides them from us.

p 2-91

488. Then at [†346] he presents their proof of what we have just stated. Now it is plain that just as an eclipse of the sun is due to the interposition of the moon between us and the sun, so the eclipse of the moon is due to the interposition of the earth between the sun and the moon. But the moon is eclipsed more often than the sun. This they said is due to the fact that there is but one solitary moon to eclipse the sun when interposited between us and it, but the moon is eclipsed not only by the earth on which we live but by several other earths.

p 2-91

But this argument of theirs is of no worth, because the moon is never found to be eclipsed except by the interposition of this earth between the moon and the sun, namely, when the moon enters the shadow of this earth. Eclipses of the moon occur more frequently than those of the sun, because a solar eclipse is very often impeded on account of the diversity of aspect.

p 2-91

489. Then at [†347] he shows how they meet arguments leveled against them. The chief of these is that, unless the earth were in the middle of the world, the horizon which is a plane passing through our sight would not always cut the entire sphere and the greatest circles into two halves, in such a way, namely, that six signs [of the Zodiac] are always visible to us above the earth and six are under the earth.

p 2-91

But their answer to this was that the whole earth is not a center, because a center is indivisible and a point, whereas the earth is a body possessing size.

p 2-92

Hence, our circle which is on the surface of the earth is a full hemisphere's distance from the center — yet this does not prevent everything from appearing to us as though our eye were in the center. The reason for this is the smallness of the earth, which is as though nothing in size in comparison with the whole heaven. In like manner, they thought that if the earth on which we live is not in the middle, all things would appear to us as though the earth were in the middle of the universe, because even now the distance from the middle is not manifest as to appearance, although our sight is distant from the middle of the universe by half the earth.

p 2-92

But this could be understood if the earth were a small distance from the middle but not if it were at a great distance therefrom. There are also certain other appearances which would not be saved if the earth were not in the middle — for example, what occurs in an eclipse of the moon, when there is direct opposition of the moon to the sun. For, unless the earth were always in the middle, an eclipse of the moon would not always occur when it is in opposition in the head or tail — yet our aspect counts for nothing in an eclipse of the moon.

p 2-92

490. Then at [†348] he presents a second opinion. And he says that some, although they say that the earth is in the center, yet say it is moved and revolved "about the never-shifting pole," i.e., about the axis of the world (for sometimes the heaven is called the "pole," sometimes the axis is, and sometimes the ends of the axis, as when we speak of the arctic and antarctic pole). And this opinion, he says, is found in the *Timaeus*. But it should be noted that Aristotle took what is here called "revolved" or "turned," from Plato's statement in the *Timaeus:* in Greek, "illomenum" about the pole in every way ordered. Now if *illomenum* is written in Greek with an iota, it means a "binding," but if written with a diphthong, it means "a hindrance." Now this word seems to be taken by Plato as it means a "binding," as is plain from what he says about the earth in the *Phaedo,* where he asserts it to be at rest in the middle and, as it were, held fast. Consequently, Aristotle seems to have taken the words of Plato in a way not intended by him.

p 2-92

Therefore, Alexander, excusing Aristotle, says that *illomenum* properly signifies "preventing" or "compulsion," but because that meaning does not fit what Plato intends to say here Aristotle understood him as taking it in the extended sense of meaning, as transferred, "turning," which denotes motion. Nor does it make any difference in the present argument whether Plato has said elsewhere something that differed from what he had said, in the *Phaedo,* for some other reason. For Aristotle is here proposing what is written in *Timaeus* whether it be introduced as an opinion accepted by Plato, or as the opinion of Timaeus, which he does not approve. That is why he does not say "as Plato says," but "as is written in the *Timaeus.*"

p 2-92

But Simplicius has a barrage of objections against this. First, because Timaeus there proves the earth is located and settled in the middle. Secondly, because there the word *illomenum* is written with an iota, and thus signifies a "holding fast." Thirdly, because a "turning" does not always imply motion — for circular figures are said to be "turned," i.e., facing [turned] in every direction, even if they are at rest. Fourthly, because, since this word has many meanings, one should not have bent its meaning to a sense plainly contrary to Plato's intention.

p 2-92

But, against this, Simplicius again objects that it is not probable that Aristotle was ignorant either of the meaning of the word or of Plato's intention. Consequently, it can be said that, because it was possible for some to falsely interpret Plato's words, Aristotle removes the false understanding that could be obtained

some to falsely interpret Plato's words, Aristotle removes the false understanding that could be obtained from these words, as he frequently does with passages from Plato.

p 2-93

Or it can be said that the phrase, "and to be moved," is an interpolation by another In the Greek there is stated *illesthai,* which is here translated, "to be revolved." Now what is written in the Greek can signify both a "holding fast" and "motion," so that we can understand that after Aristotle presented the Pythagorean theory of the motion of the earth about the middle, he here presents Plato's theory about the earth being at rest in the middle.

p 2-93

We can also say more briefly that one Heraclitus of Pontus posited the earth to be in motion in the center and the heaven to be at rest, and that it is his opinion that Aristotle is here introducing. The fact that he adds, "as stands written in the *Timaeus,*" is to be referred, not to what was said, namely, "it is revolved and moved," but to what follows, namely, "that it is upon a fixed pole."

p 2-93

491. Then at [†349] he gives the theories about the shape of the earth. And first he presents the theories, and states that there are likewise problems about the shape of the earth, as there are about its motion and position. For some think that it is spherical, others that it is wide and having the shape of a tambourine.

p 2-93

492. Secondly, he presents two reasons used to support this second theory. The first of these [†350] is that they make an argument of the fact that as the sun rises and sets, it is cut by the earth according to a straight, and not a circular, line — namely, when part of the sun appears above the earth, and part is hidden. Now if the earth were spherical, the line of section would seem to have to be circular, because two spherical bodies intersect with a circular intersection.

p 2-93

But he excludes this argument at [†351], and says that those who present this argument do not consider the sun's distance from the earth and the greatness of the rotundity of each. For we sometimes see that even small circles, seen from afar, appear after the manner of a straight line. There is all the more reason, therefore, for portions of large circles to appear straight from a distance, because they are less curved. However, this must be principally understood when the circle is in the same surface as our vision — for the intersection of the sun and moon, which is not in the same surface with our sight, is not seen as straight but as circular, as was said above when discussing the shape of the stars.

p 2-93

493. He gives a second argument at [†352] and says that they add a further argument for the same, namely, that if the earth is to be at rest, it has to be flat. For a spherical shape is easy to move, because so little of it is in contact with a plane; but a wide shape is totally in contact with a plane, and is consequently apt for rest.

p 2-93

And lest anyone believe that this explanation of the earth's rest is generally assigned by everyone, he adds that there are many different ways in which the motion and rest of the earth has been conceived, as will be plain from what will be said below.

Lecture 22 (Aristotle's Text)

294a10-294a21

[353] The difficulty must have occurred to every one. It would indeed be a complacent mind that felt no surprise that, while a little bit of earth, let loose in mid-air, moves and will not stay still, and the more there is of it the faster it moves, the whole earth, free in mid-air, should show no movement at all. Yet here is this great weight of earth, and it is at rest. And again, from beneath one of these moving fragments of earth, before it falls, take away the earth, and it will continue its downward movement with nothing to stop it. The difficulty then, has naturally passed into a commonplace of philosophy; [354] and one may well wonder that the solutions offered are not seen to involve greater absurdities than the problem itself.

294a22-294b13

[355] By these considerations some have been led to assert that the earth below us is infinite, saying, with Xenophanes of Colophon, that it has 'pushed its roots to infinity', †1-in order to save the trouble of seeking for the cause. [356] Hence the sharp rebuke of Empedocles, in the words 'if the deeps of the earth are endless and endless the ample ether—such is the vain tale told by many a tongue, poured from the mouths of those who have seen but little of the whole'. †2[357] Others say the earth rests upon water. This, indeed, is the oldest theory that has been preserved, and is attributed to Thales of Miletus. It was supposed to stay still because it floated like wood and other similar substances, which are so constituted as to rest upon water but not upon air. [358] As if the same account had not to be given of the water which carries the earth as of the earth itself! It is not the nature of water, any more than of earth, to stay in mid-air: it must have something to rest upon. [359] Again, as air is lighter than water, so is water than earth: how then can they think that the naturally lighter substance lies below the heavier? [360] Again, if the earth as a whole is capable of floating upon water, that must obviously be the case with any part of it. But observation shows that this is not the case. Any piece of earth goes to the bottom, the quicker the larger it is. [361] These thinkers seem to push their inquiries some way into the problem, but not so far as they might. It is what we are all inclined to do, to direct our inquiry not by the matter itself, but by the views of our opponents; and even when interrogating oneself one pushes the inquiry only to the point at which one can no longer offer any opposition. Hence a good inquirer will be one who is ready in bringing forward the objections proper to the genus, and that he will be when he has gained an understanding of all the differences. †1

Lecture 22 (Aquinas' Commentary)

The problem about the earth's rest.

p 2-94

494. After rejecting the opinions of those who held false theories about the earth, the Philosopher here pursues the opinions of those who, while holding a true theory about the earth, namely, that it is at rest, assigned unsuitable explanations for the earth's rest.

p 2-94

First he poses the problem;

Secondly, he points out where the solutions which others proposed are insufficient, at 496;

Thirdly, he examines these solutions, each in turn, at 497.

p 2-94

495. He says therefore first [†353] that it seems necessary that a certain problem about the earth should occur to everyone. For if someone did not wonder about this, he would seem to have an irrational mind, as though not being able to perceive the difficulty, namely, as to how it is that, if some small particle of earth be raised against its nature and then released, it is borne downward and "does not wish to remain," i.e., has no natural tendency to rest, and the larger the particle of earth is, so much the faster does it move downward. Yet it seems that if the whole earth could be raised by someone on high out of its place, and then let loose, it would not move down. This seems so from what presently happens in regard to the whole earth. For, while it does have great heaviness, it does not move downward but remains at rest in its place. Hence, it seems that no matter where in the world the earth might be set, it would rest there, for the same reason that it now rests in this place. This, indeed, is in keeping with the opinion of those who suppose that any place at random is suitable for just any body.

p 2-94

But someone could say that the particles of earth, when lifted and then released, move down no farther than the place where earth now is. Therefore, in order to augment the difficulty, he adds that if someone were to raise some particles of earth, and it should happen that, before the falling particles returned to earth, someone should remove the earth from their place, then those clods would move "downward," i.e., farther downward than the place from which they were picked up, since nothing would now be there to stop them. Now we can guess about the whole from the part — for if someone should throw a stone upward and then, before it fell, dig a ditch in the earth, that stone would fall until it encountered an obstacle; and thus it seems strange that, since the earth as a whole has no resistance from anything impeding its descent, it does not move downward.

p 2-94

He concludes therefore that the "stupor," i.e., the great wonder, evoked by this made it a "philosophema," i.e., a consideration of philosophy or occasion for philosophizing for all philosophers — just as in the beginning of the *Metaphysics* it is said that it is from wonder that men began to philosophize.

p 2-94

496. Then at [†354] he presents the inadequacy of the solutions proposed on this point by the philosophers. And he says that one can wonder, not only at the way things happen thus with regard to the earth, but also why philosophers trying to solve this problem have not seen that their solutions given to this problem are more at odds than the problem itself. For they have given forth theories more improbable than the situation which gives rise to the problem — hence those solutions only increase the problem.

497. Then at [†355] he presents five solutions of the aforesaid problem:

The second one begins at 499;

The third at Lecture 23;

The fourth at Lecture 24;

The fifth at Lecture 25.

p 2-95

With respect to the first he does two things:

First he presents the first solution [†355]. And he says that some, for the sake of this, i.e., in order to evade the problem, assert that the earth's downward direction is infinite. Now this can be understood in two ways: In one way, that the air below the earth is infinite, implying that the reason why the earth is moved no farther down is because nothing is moved to an infinite goal. In the other and truer interpretation, it is taken to mean that the earth itself is infinite on its nether side, and thus the upper part is sustained by a lower part extending to infinity. This is more quickly understood and is said to have been the theory of Xenophanes of Colophon. They put this forth, not because it seemed more plausible in itself, but in order to save the trouble of laboring to find the cause of the earth's rest.

p 2-95

498. Secondly, he tells how Empedocles derided this solution. And he says that, since the aforesaid men did not assert this as though plausible but in order to side-step the question, Empedocles was "stupefied," i.e., greatly astonished at their error, speaking as follows in the verses he composed philosophy: "Are indeed the deeps of the earth endless" (as though to say: Is the earth infinitely deep?) "and endless too the ether?" i.e., air or fire. And he says that these opinions have been "vainly poured out," i.e., asserted without reason, "since they have been told by many a tongue" (as if to say: from the mouths of many men) "who understood but little of the whole," i.e., understanding but little about the nature of the universe. In these words, he gives us to understand that it is from a lack of intelligence that some said this with their mouths alone, while, as interiorly considered, it is not plausible.

p 2-95

Now Aristotle contented himself with this rebuke by Empedocles, both on account of the improbability of what is said and because it has been previously shown in Book I that there cannot be infinite weight.

p 2-95

499. Then at [†357] he takes up the second solution.

First he proposes it;

Secondly, he refutes it, at 500;

Thirdly, he underscores the reason for the defects in solutions of this kind, at 503.

p 2-95

He says therefore first [†357] that just as the aforesaid philosophers posited the earth to be held up by earth *ad infinitum,* so others declared the earth to be set on water. This indeed is the oldest theory, proposed, they say, by Thales of Miletus, who was one of the seven called "Wise Men," and the first to interest

himself in natural philosophy. It was he who posited water as the principle of all things, as is said in *Metaphysics* I. Hence he posited the earth to be set upon water and to rest there in the manner of flotation, as occurs with wood and other similar substances, none of which naturally remains in air, but they do remain in water in this wise because of floating. And the same thing happens with the earth, they claimed.

p 2-95

500. Then at [†358] he refutes what has been said with three arguments. And he says that the previous solution was proposed as though the same account had not to be given of the water which sustains the earth as of the earth itself. For we see that just as earth, if raised up, does not remain unless it is supported by something, so neither is water, when raised, apt to remain so, but it must be in something supporting it, if it is to remain at rest. Therefore, if earth were sustained by water, the same problem would remain — by what is the water supported?

p 2-96

501. He gives the second argument at [†359], namely, that just as air is lighter than water, so water is lighter than earth, or less heavy. Now it is the nature of something lighter to rise above that which is heavier by nature. Therefore, it is not possible for water, which is lighter, to be placed lower than earth, which is heavier, according to nature — unless someone should say that the parts of the world are not ordered according to nature, which is unacceptable.

p 2-96

502. The third reason at [†360] is this: As was had in Book I, natural motion, and the rest as well, of the entire earth and of a clod is the same. If, therefore, the whole earth is apt to remain in water and float on it, it plainly follows that any particle of it could remain afloat on the water. But this is not what we see happening; rather, any particle of earth placed in water sinks to the bottom, the quicker the larger it is. Therefore, much more quickly would the whole earth sink, if it were set upon water.

p 2-96

503. Then at [†361] he indicates the reason why these arguments are deficient. And he says that the reason why they give such defective solutions is that they seem to investigate a problem up to a certain point but not as far as it is possible to inquire. But anyone who desires to solve problems properly must push his solution to the point where no doubts remain. This is something they failed to do.

p 2-96

He assigns the reason for this, and counts himself in with the others, to avoid being boastful, and says that it seems to be the practice of all of us when resolving problems to investigate, "not in terms of the thing, but in terms of the one contradicting," i.e., not as far as the nature of the matter requires but until an adversary offers no further contradiction. A man even does this with himself — when wondering about something he interrogates himself until he can no longer find to hand anything to contradict his view. But this is not enough. When someone wants to find a true solution, he must not be content merely with answering the objections he has to hand, but must diligently seek them out. Wherefore, as he says, anyone who wishes to be a good inquirer after truth must be ready to object against himself and others, not with sophistries but with real and reasonable objections proper to, i.e., befitting the genus under investigation. This arises when a man considers all the differences of the things from whose similarities a problem is solved. For example, Thales solved the present question on the basis of wood's similarity to water, but he should have considered the difference between them as well, For wood, because it contains much air, floats on water, which is not true of earth.

Lecture 23 (Aristotle's Text)

294b14-294b23

[362] Anaximenes and Anaxagoras and Democritus give the flatness of the earth as the cause of its staying still. Thus, they say, it does not cut, but covers like a lid, the air beneath it. This seems to be the way of flat-shaped bodies: for even the wind can scarcely move them because of their power of resistance. The same immobility, they say, is produced by the flatness of the surface which the earth presents to the air which underlies it; while the air, not having room enough to change its place because it is underneath the earth, stays there in a mass, like the water in the case of the water-clock. †1 And they adduce an amount of evidence to prove that air, when cut off and at rest, can bear a considerable weight.

294b24-294b30

[363] Now, first, if the shape of the earth is not flat, its flatness cannot be the cause of its immobility. [364] But in their own account it is rather the size of the earth than its flatness that causes it to remain at rest. For the reason why the air is so closely confined that it cannot find a passage, and therefore stays where it is, is its great amount: and this amount is great because the body which isolates it, the earth, is very large. This result, then, will follow, even if the earth is spherical, so long as it retains its size. So far as their arguments go, the earth will still be at rest.

294b31-295a14

[365] In general, our quarrel with those who speak of movement in this way cannot be confined to the parts †2 it concerns the whole universe. One must decide at the outset whether bodies have a natural movement or not, whether there is no natural but only constrained movement. Seeing, however, that we have already decided this matter to the best of our ability, we are entitled to treat our results as representing fact. Bodies, we say, which have no natural movement, have no constrained movement; and where there is no natural and no constrained movement there will be no movement at all. This is a conclusion, the necessity of which we have already decided, †3 and we have seen further that rest also will be inconceivable, since rest, like movement, is either natural or constrained. But if there is any natural movement, constraint will not be the sole principle of motion or of rest. If, then, it is by constraint that the earth now keeps its place, the so-called 'whirling' movement by which its parts came together at the centre was also constrained. (The form of causation supposed they all borrow from observations of liquids and of air, in which the larger and heavier bodies always move to the centre of the whirl. This is thought by all those who try to generate the heavens to explain why the earth came together at the centre.

Lecture 23 (Aquinas' Commentary)

Lecture 23

The cause of the earth's rest is not supporting air.

504. Having presented two solutions, the first of which derived the cause of the earth's rest from the infinitude of the nether part of the earth, while the second derived it from water being under the earth, he here gives a third solution in which the cause is ascribed to air supporting the earth.

First he presents the solution;

Secondly, he refutes it, at 505.

He says therefore first [†362] that Anaximenes and Anaxagoras and Democritus gave the broadness of the earth as the cause of its state of rest. That is why it happens that the earth does not cut the air beneath it, but rides upon it.

Now this is indeed what seems to be done by bodies purposely made wide in order to resist air and wind: for such very wide bodies do not seem to be easily moved by winds because they resist them along their entire width. This, too, the earth, because of its width, seems to do with respect to the air under it, i.e., instead of cleaving it, the earth resists and compresses it. And since the air has no place to move in order not to be under the earth, because of the earth's width, the vast amount of pressed air under the earth is sufficient to uphold it, like the water in the case of the water-clock. For if a vessel with a small opening in the top, which is stopped up, and in the side another such opening not so stopped up, be suddenly submerged in water, the air imprisoned within, having no place to escape to, will keep water from entering. Similarly, the air residing under the earth, being pressed down by it and unable to escape, prevents the earth from falling.

And they adduce many "arguments," i.e., sensible signs, to show that air imprisoned and at rest, i.e., which cannot escape in any direction, sustains a great heaviness. And this is particularly true of inflated skins, which can support a great weight.

505. Then at [†363] he refutes this solution with three arguments. The first of these is that this solution assumes the earth to be broad. But as we shall see later, this is false. Hence, if the earth is not broad but spherical, it will follow that its width will not account for its state of rest, as they alleged.

506. He gives the second argument at [†364]. And he says that although they assign the earth's width as the cause of its rest, yet, according to that from which they proceed, it seems that it is the earth's size rather than its width that causes it to rest. For they say that the air, having no place to go because it is prevented by the earth, remains because there is so much of it, and because of this holds up the earth. But the reason why a vast amount of air is kept in confinement by the earth is that it is compressed by the enormous magnitude of the earth. Hence it seems that the same argument would hold if the earth were assumed to be spherical and of such a great size that it could confine the same amount of air — for then, too, the air and

the earth would remain, according to the reason they give.

p 2-98

507. He gives the third argument at [†365] and he says that against those who thus speak about the motion and rest of natural bodies there arises a doubt not "about the part," i.e., concerning any particular body, such as earth or water, but concerning the entire universe and every natural body. For the first thing that seems to have to be determined in such problems is whether bodies have some natural motion, or none, and whether, if they do not have a natural motion, they can have violent [compulsory] motion. And because this question has already been determined, namely, in Book I, we must now use as "in existence," i.e., as true, all that we have previously established on this point according to the power that was then present in our talent.

p 2-98

For it has been shown above that, if there is no natural motion of bodies, neither can there be any compulsory motion thereof, because the compulsory is, as it were, a departure from that which is according to nature, as has been had above. But if there is neither a natural nor a compulsory motion of bodies, it follows that nothing is in motion at all — that this is so has been previously determined. To this must be added, according to what has been previously determined, that for the same reason nothing can be at rest — for just as there is motion which is natural and compulsory, so too, rest which is natural and compulsory. But if natural motion does exist, then there will not be compulsory motion alone nor compulsory rest alone — because, into whatever place a thing is moved naturally, there it also rests naturally.

p 2-98

Having prefaced these points as principles, he argues to his proposition and concludes from these premises that, if the earth's rest in the middle is not natural but compulsory, it follows that its motion to the middle is not natural but is due to compulsion exercised by the circumgyration of the heaven. For all who maintain that the earth rests in the middle through compulsion assign this cause of the motion of the earth to the middle, namely, the circumgyration of the heaven, basing themselves on the consideration of what happens in the case of liquids, and also of air, namely, that the larger and heavier masses are gathered in the middle as though more violently repelled by the violence of the gyration. Hence all who posit a world that began by generation say that the earth came to the middle for the reason stated, i.e., on account of the compulsion induced by the heaven's circumgyration. They thus take from the earth both natural rest and natural motion. But this is unacceptable, because it follows, according to what has been said, that in their entirety natural bodies are neither in motion nor at rest.

Lecture 24 (Aristotle's Text)

295a15-295a29

[366] They then seek a reason for its staying there; and some say, in the manner explained, that the reason is its size and flatness, others, with Empedocles, that the motion of the heavens, moving about it at a higher speed, prevents movement of the earth, as the water in a cup, when the cup is given a circular motion, though it is often underneath the bronze, is for this same reason prevented from moving with the downward movement which is natural to it. †1 [367] But suppose both the 'whirl' and its flatness (the air beneath being withdrawn †2 cease to prevent the earth's motion, where will the earth move to then? Its movement to the centre was constrained, and its rest at the centre is due to constraint; but there must be some motion which is natural to it. Will this be upward motion or downward or what? It must have some motion; and if upward and downward motion are alike to it, and the air above the earth does not prevent upward movement, then no more could air below it prevent downward movement. For the same cause must necessarily have the same effect on the same thing. †3

295a30-295b9

[368] Further, against Empedocles there is another point which might be made. When the elements were separated off by Hate, what caused the earth to keep its place? Surely the 'whirl' cannot have been then also the cause. [369] It is absurd too not to perceive that, while the whirling movement may have been responsible for the original coming together of the parts of earth at the centre, the question remains, why now do all heavy bodies move to the earth. For the whirl surely does not come near us. [370] Why, again, does fire move upward? Not, surely, because of the whirl. But if fire is naturally such as to move in a certain direction, clearly the same may be supposed to hold of earth. [371] Again, it cannot be the whirl which determines the heavy and the light. †1 Rather that movement caused the pre-existent heavy and light things to go to the middle and stay on the surface respectively. Thus, before ever the whirl began, heavy and light existed; and what can have been the ground of their distinction, or the manner and direction of their natural movements? In the infinite chaos there can have been neither above nor below, and it is by these that heavy and light are determined.

295b10-2995b10

It is to these causes that most writers pay attention: . . .

Lecture 24 (Aquinas' Commentary)

p 2-99
Lecture 24

Earth's rest not from gyration of the heaven.

508. Having presented three reasons for the earth's rest, taken on the part of the lower bodies, namely, earth, water and air, he here presents other arguments taken on the part of the heavenly body.

First he gives the fourth reason for the earth's rest, namely, the one which Empedocles gave;

Secondly, he refutes it, at 509.

He says therefore first [†366] that, since all the philosophers who assert that the world was generated, assign, as the cause of the earth's movement to the middle, the violence of the heaven's circumgyration, they also inquire into the reason why the earth rests in the middle. Some say that the cause of this is the earth's width and size, as was said above; but others, such as Empedocles, assert that the motion of the heaven around the earth is so swift that it keeps the earth from being moved. And they give the example of water contained in *cyathi*, i.e., certain bronze vessels. For if that vessel be given a quite rapid circular motion and there is an opening in some part of the bronze vessel, then, after the vessel is spun a number of times, the water will descend to the bottom of the bronze vessel where the opening is; yet it will not fall out of the vessel (as it normally should according to its natural inclination) for the same reason, namely, because it is prevented by the speed of the vessel's motion in such a way that the water is seized by the motion of the vessel before it can fall. With a like argument, they say that the earth is prevented by the speed of the heaven's motion from being able to fall downwards.

509. Then at [†367] he rejects this reason.

First with respect to the earth's rest;

Secondly, with respect to its motion.

In regard to the first he does two things:

First he rejects the cause of the earth's rest in general, both with respect to those who assign the width or size of the earth as the cause of its rest, and also with respect to Empedocles;

Secondly, he specifically rejects this theory as far as it pertains to Empedocles, who assigned the speed of the heaven's motion as the cause of the earth's rest, at 510.

He says therefore first [†367] that, since the aforesaid philosophers declare that the cause of the earth's rest is the motion of the heaven, or the earth's width which corners the lower air so that it cannot escape, then it seems necessary that, if the heaven's gyration should not restrain the earth from moving, and if the earth's width should not restrain it by confining the air, but the air should freely come and go, the earth would be carried somewhere — since now, the causes of rest removed, it would have to move. But it does not seem, according to their theory, that it would be carried to the middle according to its nature. If, then, as they say, the earth is carried to the middle by compulsion, then it would have to rest in the middle by compulsion, which they also posit.

However, the earth has to have some natural motion after all compulsion ceases — for all bodies have some motion that is natural, as has been said above. It remains, therefore, to investigate in which direction the earth would be moved naturally, if all compulsion ceased — whether upward, or downward, or in some other direction, e.g., to the right or to the left, for it certainly must have some natural motion. Nor can a reason be found for it to be naturally moved in any other direction except down and to the middle, as is evident from the motion of particles of earth, which are naturally moved in no other direction. Consequently, in assigning compulsion as the cause of the earth's rest in the middle, they make a poor choice.

p 2-100

But if they say that the natural motion of the earth does not incline it downward any more than upward, it seems to follow that, just as the air which is atop the earth does not keep it from being moved upward, so too neither will the air under the earth keep it from being moved downward, whether on account of the air's being confined by the earth's width or on account of its being revolved by the motion of the heaven — because, in dealing with the same things as to the same effects, the same causes must be posited.

p 2-100

510. Then at [†368] he specifically disproves Empedocles' solution. Here it should be kept in mind that Empedocles posited four material elements and two movers, namely, friendship and strife, which, by associating and disassociating the elements, are the cause of the generation and corruption of the world and all things in the world. Aristotle says, therefore, that someone can bring against Empedocles the following difficulty: When the elements were separated from one another by strife, earth had to be at rest — because it did not join itself to the other elements so long as strife ruled. Therefore, one should ask what caused earth to be at rest at that time. One cannot give as a cause the gyration of the heaven, because the heaven had not yet been generated. It seems, therefore, that one can in no way say that the gyration of the heaven is the cause of the earth's rest.

p 2-100

But there seems to be some problem about this argument. For strife seems to be the cause of the generation of the world by disassociating the elements from one another, while friendship seems to be the cause of its corruption by uniting the elements into one chaos. Hence, one seems to have at present the rule of strife, since the elements are disassociated from one another.

p 2-100

Accordingly, Alexander expounds these words in the following manner: "When the elements were apart," means, not "from one another," but "from strife," i.e., at the time when strife was disassociated from the elements, namely, at the time when friendship ruled.

p 2-100

But because this explanation seems extorted, it should be explained as Simplicius says, as follows: "When the elements were apart," i.e., "from one another," and this "from strife," i.e., on account of strife. For it must be remembered that Empedocles explained the generation of the world, not in terms of strife alone, but with an admixture of friendship as well. And, as he [Simplicius] proves from the words of Empedocles, it is from the dominance of friendship that the circumgyration of the heaven comes, since the motion of the heaven masses, as it were, all things into one. Therefore, it is suitable for Aristotle to ask: What was the cause of the earth's rest before the gyration of the world was, according to Empedocles, caused by friendship?

p 2-100

511. Then at [†369] he rejects the reason which they assign in general for the motion of the earth. This he

does with three arguments. With respect to the first of which, he says that it is unacceptable not to consider why it is that, if before, when the world was being generated, the parts of earth were carried to the middle on account of the heaven's gyration, now, when such a cause can no longer be assigned, we still see all heavy things carried to the middle. For the heaven's gyration rotates at once fire and the upper region of air, but not this lower region of air — and, consequently, this gyration does not reach as far as us. Yet we observe that heavy things are carried to the middle in this air near us. Therefore, the gyration of the heaven ought not be posited as the cause of heavy things' being moved to the middle — because if the cause is taken away, so too the effect.

p 2-101

512. At [†370] he presents the second argument. And he says that we must consider why it is that fire is borne upwards. For it cannot be said that this is due to the heaven's gyration — since the example they give does not extend this far. However, if it is on account of its natural inclination that fire is borne to some certain place, then it is plain that the same should be thought of earth, which has contrariety to fire, as has been said above — for the motions of contraries are themselves contrary, and if one of the contraries is natural, the other too must be natural, as has been said.

p 2-101

513. He presents the third reason at [†371] and says that if anyone considers their words and examples, it does not seem that one should say that the heavy is distinguished from the light among bodies on account of the heaven's gyration, but that, if we presuppose the distinction between the heavy and the light, then some, namely, the heavy, move to the middle, while others, namely, the light, try to move upward, insofar as they are repelled from the middle place by the heavy bodies carried there. Consequently, it is only by accident that the heaven's gyration causes the upward motion of fire. But that the gyration of the heaven does not distinguish the heavy from the light, but presupposes their distinction, can be seen from the example they adduce — for in the gyration of air and liquids, things that are already heavy are carried to the middle. Consequently, before there was a gyration of the heaven, there existed heavy and light. These were distinguished according to something, namely, their aptitude to be moved in some way and to some certain place — for a thing is called "heavy" or "light" on account of an inclination to some certain local motion. Consequently, gyration is not the reason why light things are moved upward or heavy things downward.

p 2-101

Now these could distinguish heavy and light and their places, which are above and below, because they did not posit the universe to be infinite. For it is not impossible to distinguish up and down, if they distinguish heavy and light. And because some assumed an infinite universe, namely, Anaximenes and Xenophanes, Aristotle therefore says significantly that "many" of them, but not all, were "worn out," i.e., accustomed to, and practiced in, the matter of the causes of the motion and rest of heavy and light things.

Lecture 25 (Aristotle's Text)

[372] . . .but there are some, Anaximander, for instance, among the ancients, who say that the earth keeps its place because of its indifference. †2 Motion upward and downward and sideways were all, they thought, equally inappropriate to that which is set at the centre and indifferently related to every extreme point; and to move in contrary directions †3 at the same time was impossible: so it must needs remain still. [373] This view is ingenious but not true. The argument would prove that everything, whatever it be, which is put at the centre, must stay there. Fire, then, will rest at the centre: for the proof turns on no peculiar property of earth. [374] But this does not follow. The observed facts about earth are not only that it remains at the centre, but also that it moves to the centre. The place to which any fragment of earth moves must necessarily be the place to which the whole moves; and in the place to which a thing naturally moves, it will naturally rest. The reason then is not in the fact that the earth is indifferently related to every extreme point: for this would apply to any body, whereas movement to the centre is peculiar to earth. [375] Again it is absurd to look for a reason why the earth remains at the centre and not for a reason why fire remains at the extremity. If the extremity is the natural place of fire, clearly earth must also have a natural place. But suppose that the centre is not its place, and that the reason of its remaining there is this necessity of indifference—on the analogy of the hair which, it is said, however great the tension, will not break under it, if it be evenly distributed, or of the man who, though exceedingly hungry and thirsty, and both equally, †1 yet being equidistant from food and drink, is therefore bound to stay where he is—even so, it still remains to explain why fire stays at the extremities. [376] It is strange, too, to ask about things staying still but not about their motion,—why, I mean, one thing, if nothing stops it, moves up, and another thing to the centre. [377] Again, their statements are not true. It happens, indeed, to be the case that a thing to which movement this way and that is equally inappropriate is obliged to remain at the centre. †2 But so far as their argument goes, instead of remaining there, it will move, only not as a mass but in fragments. For the argument applies equally to fire. Fire, if set at the centre, should stay there, like earth, since it will be indifferently related to every point on the extremity. Nevertheless it will move, as in fact it always does move when nothing stops it, away from the centre to the extremity. It will not, however, move in a mass to a single point on the circumference—the only possible result on the lines of the indifference theory—but rather each corresponding portion of fire to the corresponding part of the extremity, each fourth part, for instance, to a fourth part of the circumference. For since no body is a point, it will have parts. The expansion, when the body increased the place occupied, would be on the same principle as the contraction, in which the place was diminished. Thus, for all the indifference theory shows to the contrary, earth also would have moved in this manner away from the centre, unless the centre had been its natural place.

[378] We have now outlined the views held as to the shape, position, and rest or movement of the earth.

Lecture 25 (Aquinas' Commentary)

Lecture 25

Reason for earth's rest not from same relation to every part of the heaven.

514. Having presented the fourth solution according to which the explanation of the earth's rest was taken from the violence of the heaven's gyration, he [the Philosopher] here presents the fifth solution in which the explanation of the earth's rest is based on the fact of a similar relation of the heaven to the earth from all directions.

First he presents this explanation;

Secondly, he disproves it, at 515.

He says therefore first [†372] that some have said that the earth rests in the middle because of "likeness," i.e., on account of its being similarly related to every part of the heaven. Among the ancients, Anaximander held this opinion. By this he gives us to understand that some of his contemporaries believed this. For Plato is said to have posited this; yet Aristotle does not attribute it to him because above he had attributed to him the opinion that the earth was moved in the middle about the axis of the world.

Now the reason why they said that the earth stays put on account of likeness, is that there is no reason why that which is placed in the middle should be moved upward or downward, or toward other reaches of the heaven, since it is related in the same way to the extremes in every direction. Now it is impossible for it to be moved simultaneously in contrary directions. Therefore it remains that it necessarily rests in the middle.

515. Then at [†373] he disproves this explanation.

First on the ground that the argument does not have necessity;

Secondly, on the ground that it supposes something false, at 519.

He says therefore first [†373] that the statements they make appear persuasive, but are not truly so. And this he proves with four arguments. The first of these is that, if the above explanation were true, then everything placed in the middle would have to rest there (and thus it would follow that fire, if it were put in the middle, would remain at rest, which is patently false), because the cause of rest assigned here, namely, being in the middle, is not taken to be peculiar to earth — yet the effect, namely, to be at rest in the middle, is peculiar to earth.

516. The second argument is presented at [†374], and he says that it is not necessary to say that the earth rests in the middle on account of likeness, since a more suitable cause is available. For earth seems not only to rest in the middle, but to be borne toward the middle, if not according to the whole, nevertheless according to its parts. Now there is the same explanation for the motion of the whole and for that of the

part. For whithersoever a part of the earth is borne, there too the whole would be necessarily borne, should it be outside its proper place. But wherever it is borne according to its nature, there it also rests according to its nature. Accordingly, it is plain that the earth rests in the middle on account of its very nature and not because it is related in a "like" way to the extremes, since to be put in the middle can be common to all things — but to be naturally borne to the middle is peculiar to earth.

p 2-103

517. At [†375] he gives his third argument, which also shows the insufficiency of this explanation. And he says it is inappropriate to investigate why the earth rests in the middle and not investigate why fire rests in the extreme confine. For if fire rests there because the extreme place naturally suits it, then for the same reason it should be said that earth too has a natural place in which to rest. And if the middle is not the place where earth naturally rests, but it remains in the middle on account of the necessity of likeness, then they must investigate why fire remains in the extremes.

p 2-103

And he gives examples of the earth's rest in the middle based on certain arguments of the sophists, who seemed to prove that a "trichos," i.e., a hair, if vigorously stretched, would not break, because it would be stretched alike in every direction and there is no reason why it should break at one point rather than at another. But this argument is sophistical: first, because it is difficult for it to be stretched everywhere in the same way; secondly, because, even supposing this, it would break in the middle, because it is there that the violence exerted from both directions meets.

p 2-103

He gives another example, namely, of a person subject to an equal degree of hunger and thirst and having food and drink at an equal distance. The sophists conclude that such a person would remain where he is, and be moved to neither. But this does not follow: first of all, because thirst is stronger than hunger; secondly, because, if two meals or two drinks were equally desirable, he would run to whichever one he should happen to run to.

p 2-103

518. At [†376] he presents his fourth argument, which also shows the insufficiency of the aforesaid. And he says that it was strange for them to inquire into the reason why bodies rest and not inquire into the reason for their motion, namely, as to why one body is moved upward and another downward when no obstacle detains them. For nature is the principle of motion and rest in that in which it is, as is said in *Physics* II.

p 2-103

519. Then at [†377] he disproves the aforesaid explanation on the ground that it assumes something that is false. And he says that what is said in the aforesaid explanation is not true *per se* and universally. For it is *per accidens* true that "everything," i.e., a whole, must remain in the middle if there is no greater reason for it to be moved here than there. But if it should have an inclination to be moved in some direction, then, because of the fact that it is in the middle, it will not rest of necessity, but it will be moved — yet not as a whole, but divided into parts, as is evident with fire.

p 2-103

For if what they say is true, then, if fire were put in the middle of the world, it would have to remain there, as the earth does, on the ground that it would be similarly related to every point that can be designated in the heaven; yet if fire were put in the middle, it would be moved to the extreme if nothing stopped it, as it is even now seen to be moved. But yet, not all is moved to one point — and this alone was removed in the previous argument, namely, that the whole should be moved in one direction. But each portion of the fire

will be moved to a part of the heaven suitable to it — for example, a fourth part of the fire to a fourth part of the "container," i.e., the heaven; for a body is not an indivisible point. Just as parts of earth, if dispersed toward the confines of the heaven, would be condensed to come to a lesser place, namely, the middle, so also conversely, if fire were moved from the middle to the extreme, it would have, by rarefaction, to be moved from a small place to a larger place.

p 2-104

520. And thus ceases the objection upon which someone could gainsay the foregoing and declare that it is impossible for individual portions of fire to be borne to individual parts of the heaven on the ground that the extreme place exceeds the middle in quantity. For this is forestalled by the fact that through rarefaction the fire would be extended to occupy a greater place. And from this he concludes that if the middle place were not natural to earth, then, on account of likeness, it would be moved in such a way from the middle to the extreme that each of its parts would be moved to individual parts of the extreme, as was said of fire.

p 2-104

Finally, he sums up [†378] and says that this is practically all that the ancient philosophers suspected about the shape and place of the earth and about its place and its motion or rest.

Lecture 26 (Aristotle's Text)

296a24-296b5

[379] Let us first decide the question whether the earth moves or is at rest. [380] For, as we said, there are some who make it one of the stars, and others who, setting it at the centre, suppose it to be 'rolled' and in motion about the pole as axis. †1[381] That both views are untenable will be clear if we take as our starting-point the fact that the earth's motion, whether the earth be at the centre or away from it, must needs be a constrained motion. It cannot be the movement of the earth itself. If it were, any portion of it would have this movement; but in fact every part moves in a straight line to the centre. Being, then, constrained and unnatural, the movement could not be eternal. But the order of the universe is eternal. [382] Again, everything that moves with the circular movement, except the first sphere, is observed to be passed, and to move with more than one motion. The earth, then, also, whether it move about the centre or as stationary at it, must necessarily move with two motions. But if this were so, there would have to be passings and turnings of the fixed stars. Yet no such thing is observed. The same stars always rise and set in the same parts of the earth. †2

296b6-296b24

[383] Further, the natural movement of the earth, part and whole alike, is to the centre of the whole [384] —whence the fact that it is now actually situated at the centre—but it might be questioned, since both centres are the same, which centre it is that portions of earth and other heavy things move to. Is this their goal because it is the centre of the earth or because it is the centre of the whole? [385] The goal, surely, must be the centre of the whole. For fire and other light things move to the extremity of the area which contains the centre. It happens, however, that the centre of the earth and of the whole is the same. Thus they do move to the centre of the earth, but accidentally, in virtue of the fact that the earth's centre lies at the centre of the whole. [386] That the centre of the earth is the goal of their movement is indicated by the fact that heavy bodies moving towards the earth do not move parallel but so as to make equal angles, †1 and thus to a single centre, that of the earth. [387] It is clear, then, that the earth must be at the centre and immovable, not only for the reasons already given, [388] but also because heavy bodies forcibly thrown quite straight upward return to the point from which they started, even if they are thrown to an infinite distance. †2[389] From these considerations then it is clear that the earth does not move and does not lie elsewhere than at the centre.

296b25-297a7

[390] From what we have said the explanation of the earth's immobility is also apparent. If it is the nature of earth, as observation shows, to move from any point to the centre, as of fire contrariwise to move from the centre to the extremity, it is impossible that any portion of earth should move away from the centre except by constraint. For a single thing has a single movement, and a simple thing a simple: contrary movements cannot belong to the same thing, and movement away from the centre is the contrary of movement to it. If then no portion of earth can move away from the centre, obviously still less can the earth as a whole so move. For it is the nature of the whole to move to the point to which the part naturally moves. Since, then, it would require a force greater than itself to move it, it must needs stay at the centre. [391] This view is further supported by the contributions of mathematicians to astronomy, since the observations made as the shapes change by which the order of the stars is determined, †1 are fully accounted for on the hypothesis that the earth lies at the centre. [392] Of the position of the earth and of the manner of its rest or movement, our discussion may here end.

Lecture 26 (Aquinas' Commentary)

p 2-105

Lecture 26

Proof of the earth's rest in the middle.

p 2-105

521. After pursuing the opinions of others concerning the earth, the Philosopher here determines about it according to the truth.

p 2-105

First he determines the question of the earth's place and rest;

Secondly, that of its shape (L. 27).

p 2-105

As to the first he does two things:

First he determines the truth by arguments of nature;

Secondly, by signs taken from astronomy, at 530.

p 2-105

Regarding the first he does two things:

First he shows that it is impossible for the earth to be in motion;

Secondly, from the foregoing he assigns the true reason of the earth's rest, at 529.

p 2-105

Regarding the first he does three things:

First he states his intention [†379], namely, that we must first say whether the earth is in motion or at rest. For it is from motion that we must approach the other points to be considered about the earth. Therefore he presents this first in order to take it as a principle of what is to follow.

p 2-105

Secondly, at [†380] he states why it is necessary to make this enquiry. For, as has been said above, some, namely, the Pythagoreans, assumed that it is in motion about the middle of the world, as though it were one of the stars; but others, as is written in the *Timaeus,* assuming that the earth is in the middle, assert that it is revolved about the "middle of the pole," i.e., about the axis which divides the heaven through the middle.

p 2-105

522. Thirdly, at [†381] he shows that it is impossible for the earth to be thus in motion with four arguments. In the first of these he takes as a principle the fact that, if the earth is moved circularly, whether in the middle of the world or outside the middle, such a motion, as far as the earth is concerned, would have to be a compulsory one. For it is manifest that a circular motion is not the proper and natural motion for the earth, because, if it were, then every particle of earth would have to have this motion, since the natural motion of the whole and of the part is the same, as was said above. Now observation shows that this is false, for all the parts of earth are moved with a straight motion toward the middle of the world. But if a circular motion of earth is a compulsory one and beside its nature, it cannot be eternal, because, as was held in a previous lecture, nothing compulsory is eternal. But if the earth is in circular motion, that motion has to be eternal, supposing, according to his opinion, that the world is eternal — because, according to this, the world's order must be eternal, and the motion, or rest, of the chief parts of the world pertain to its order. Thus it follows, therefore, that the earth is not being moved circularly.

523. The second argument at [†382] is this: All bodies in circular motion seem to be "hesitant," i.e., they do not always retain a uniform position, since each of them is moved by several motions and not just one, except the first sphere, which is moved with one motion, and this, according to him, is the sphere of the fixed stars. If, therefore, the earth has a circular motion, whether being in the middle or outside the middle, it would have to be moved with several motions, namely, with the motion of the first sphere about the poles of the equinoctial circle and with another proper motion about the poles of the Zodiac.

But this cannot be, because, if it were, there would be changes and turnings of the fixed stars in relation to the earth, which, because of its own motion, would fail [i.e., be slowed up] and would not return to the same point simultaneously with a fixed star, either in the case of the whole earth or of some indicated part, as happens with the planets. Consequently, it would follow that the fixed stars would not always be seen to rise and set according to the same part of the earth. But this does not happen — rather they always rise and set according to the same designated places. Therefore, the earth is not circularly moved.

524. At [†383] he gives a third argument which takes its start from the motion of the parts of the earth and of the whole. Hence with respect to this he does three things:

First he proposes the condition of the natural motion of the earth and of its parts;

Secondly, he raises a problem on this point, at 525;

Thirdly, he concludes to what he intended, at 527.

He says therefore first [†383] that the motion of parts of the earth is, according to their nature, to the middle of the whole world. In like manner, if the whole earth were outside the middle of the world, it would be moved to the middle of the world according to its nature, because the natural motion of the whole and of the part is the same.

525. Then at [†384] he raises a certain problem on this point. First he proposes it, and says that if it be assumed that the earth is in the middle or center of the world, in such a way that the center of the whole world and of the earth is the same, there can be a problem as to which of these middles do heavy bodies, and especially parts of the earth move according to nature, namely, whether to the middle as it is the middle

and especially parts of the earth move according to nature, namely, whether to the middle as it is the middle of the world, or as it is the middle of the earth.

p 2-106

Secondly, at [†385] he solves the problem, saying that it is necessary that heavy bodies be moved to the middle as it is the middle of the whole world. For the motion of heavy bodies is contrary to the motion of the light. But light bodies, and in particular, fire, are moved toward the outer boundary of the heavenly body; therefore, heavy bodies, and in particular, earth, are moved to the middle of the world. But because it happens that the middle of the earth and the middle of the world are the same, the consequence is that the parts of earth are moved to the middle of the earth, not *per se,* but *per accidens,* namely, insofar as the middle of the earth and the middle of the world are the same as to subject — thus, if I know Coriscus, I know *per accidens* the one who is approaching, because Coriscus is the one approaching.

p 2-106

526. Thirdly, at [†386] he proves what he had assumed, namely, that heavy bodies and the parts of earth are moved to the middle. And he says that a sign of this is that heavy bodies are naturally borne toward the earth, "not side by side," i.e., not along equidistant lines that never meet, but "according to similar angles," i.e., right angles with respect to the surface, or a line tangent to the earth's surface. And this happens no matter from which direction a heavy body is moved toward the earth.

p 2-107

And a sign of this is that if a pillar anywhere on earth is not erected according to right angles, but leans, it will fall in the direction with which it makes an acute angle. Now it is proved in Book III of *Euclid* that, if a line is tangent to a circle, and another line is drawn down perpendicular to the tangent line at the point of contact with the circle, necessarily it will, if extended, pass through the center of the circle. Thus it is plain that all heavy bodies are moved toward the center of the earth, in such a way that, if there were no obstacle, things moved from different directions would meet in the center of the earth. The reason for this is that each of them would be moving along a straight line falling perpendicularly on a tangent at its point of contact [with the earth]. Consequently all heavy bodies must be borne toward the one middle of the world and of the earth.

p 2-107

527. Then at [†387] he concludes his proposition. And he draws two conclusions. The first of these is that the earth is in the middle of the world. This conclusion is derived thus from the foregoing. All heavy bodies are moved *per se* to the middle of the world. But all are likewise moved to the middle of the earth, as has been proved. Therefore, the middle of the earth is the middle of the world. And so the earth is in the middle of the world.

p 2-107

The second conclusion is that the earth is immovable. This is concluded from the foregoing as follows: Nothing is moved in the place toward which it is naturally moved. But the earth is naturally moved to the middle of the world. Therefore, it is not in motion there. But it is nowhere but in the middle of the world, as has been proved. Therefore the earth is not in motion in any way.

p 2-107

528. He gives a fourth argument at [†388] For we observe that if a stone at rest on a tablet is thrown straight up into the air and then falls along the same straight line that it described in its upward flight, and the tablet is not moved, the stone will fall into the same place where it previously was. But if the tablet is moved, the stone will fall in another place [than the tablet], so much the more distant as the stone was thrown higher — since, according to this, there will be more time between the beginning of the throwing and the end of the fall. However, when heavy objects are thrown upward "according to rule," i.e.

and the end of the fall. However, when heavy objects are thrown upward "according to rule," i.e., according to a straight line, they again return to the same place on earth whence they were thrown. And lest anyone should say that this happens due to the slowness of the earth's motion, which makes the difference between the two places to be imperceptible, he adds that the same thing will happen if someone throws the stone up an infinite number of times, one after the other, i.e., long enough to make perceptible the distance intervening between the places. Thus it is plain that the earth is not in motion.

p 2-107

Then in summing up he concludes [†389] that it is plain from the foregoing that the earth is neither in motion nor has any position outside the middle of the earth.

p 2-107

529. Then at [†390] he assigns the cause of the earth's rest. And he says that from the foregoing it is plain what the cause of its rest is. For, as has been said, earth is naturally inclined to be borne to the middle from every direction, as our sense observations indicate — and similarly it is apparent to sense that fire is naturally moved from the middle of the world to the extreme. Hence it follows that no particle of earth, small or large, can be moved from the middle except by violence; for, as was had in Book I, one body has one natural motion, and to a simple body belongs a simple motion, so that two contrary motions cannot belong to a simple body. But a motion from the middle is contrary to one toward the middle. And so, if it is true that no portion of earth can be borne from the middle except through violence, it is plainly much more impossible that the entire earth be moved from the middle.

p 2-108

However, someone could object that the whole earth is not in motion to the middle. But he excludes this by saying that the whole earth is apt to be borne whither a part is apt to be borne. And so, if a part of the earth is naturally moved to the middle, then the whole earth will be naturally moved thither. And so it is impossible that it be moved from the middle; hence it is necessary that it rest in the middle.

p 2-108

530. Then at [†391] he uses the findings of astronomers to confirm his teachings about the earth's position and state of rest. And he says that what has been said, namely, that the earth is in the middle and rests there, is attested to by the statements of the mathematicians concerning astronomy. For what sensibly appears concerning the shifting of configurations, determined by the position and order of the stars, can be saved if the earth is at rest in the middle and not otherwise.

p 2-108

For as Ptolemy says, if the earth were not in the middle, then it would have to be subject to one of three dispositions. One of these is that the axis of the world would be outside the earth, and yet the earth would be equidistant from each of the poles. The second is that the earth would be on the axis and would approach closer to one pole than to the other. The third is that the earth is neither on the axis nor equidistant from each of the poles.

p 2-108

Now if the earth were situated in the first way, namely, so that the earth would be outside the axis but equidistant from each pole, then, whether it were above or below the axis, the horizon of people living in the right sphere would have to divide the equinoctial circle and all equidistant circles into unequal parts; consequently, there would never be an equinox in the right sphere. In the oblique sphere either there never would be an equinox, or else it would not occur between two solstices — because the horizon could never divide the greatest of the equidistant circles into two halves, although perhaps one of the others. But if the earth leaned away from the axis in either an easterly or westerly direction, it would follow, first of all, that

the stars would not appear equal in their rising and setting on account of the inequality of distance. Secondly, it would follow that the interval of time from sunrise to highest elevation, when it is most above our heads, would not be equal to the space of time until sunset.

p 2-108

But if the earth were disposed in the second way, namely, with the earth on the axis but nearer to one of the poles than to the other, two unacceptable things would follow. First of all, because it would be in the right sphere alone that the horizon would divide the heaven into two halves, whereas in the oblique sphere the smaller part of the heaven would always be related to the visible pole, and the larger part to the hidden pole. And thus it would follow that the horizon of the oblique sphere would not divide the Zodiac into two halves; the contrary of which is apparent from the fact that we see six signs over the earth. Secondly, because if the earth were not directly situated under the equinoctial circle [i.e., the equator], it would follow that the eastern shadows of erect bodies at the equinoxes would not be in a straight line with those of the west — but the contrary of this is observed.

p 2-108

And from this it is plain that neither is the third way possible, namely, that the earth be neither on the axis nor equidistant from each of the poles, because, on this position, all the aforesaid impossibilities would follow. Moreover, no matter which way the earth should fail to be in the middle of the world, the entire order in the increasing and decreasing of days and nights would be confused. Similarly disturbed would be the rules of eclipses; for eclipses of the moon would not always occur when sun and moon are in direct opposition, if the earth were not in the middle.

p 2-109

531. That the earth is not in a motion that passes from place to place is due to its always being in the middle. And again it would follow, no matter with what sort of motion it were moved, that the swiftness of its motion would conceal from us all other motions whether of clouds or of animals. For a slower moving object does not seem to be in motion when side by side with a faster moving object.

p 2-109

Thus, therefore, in summary, the Philosopher concludes [†392] that so much has been said above about the manner of the earth's place and its motion and rest.

Lecture 27 (Aristotle's Text)

297a8-297b13

[393] Its shape must necessarily be spherical. For every portion of earth has weight until it reaches the centre, and the jostling of parts greater and smaller would bring about not a waved surface, but rather compression and convergence †2 of part and part until the centre is reached. [394] The process should be conceived by supposing the earth to come into being in the way that some of the natural philosophers describe. †3 Only they attribute the downward movement to constraint, and it is better to keep to the truth and say that the reason of this motion is that a thing which possesses weight is naturally endowed with a centripetal movement. When the mixture, then, was merely potential, the things that were separated off moved similarly from every side towards the centre. [395] Whether the parts which came together at the centre were distributed at the extremities evenly, or in some other way, makes no difference. If, on the one hand, there were a similar movement from each quarter of the extremity to the single centre, it is obvious that the resulting mass would be similar on every side. For if an equal amount is added on every side the extremity of the mass will be everywhere equidistant from its centre, i.e. the figure will be spherical. But neither will it in any way affect the argument if there is not a similar accession of concurrent fragments from every side. For the greater quantity, finding a lesser in front of it, must necessarily drive it on, both having an impulse whose goal is the centre, and the greater weight driving the lesser forward till this goal is reached. [396] In this we have also the solution of a possible difficulty. The earth, it might be argued, is at the centre and spherical in shape: if, then, a weight many times that of the earth were added to one hemisphere, the centre of the earth and of the whole will no longer be coincident. So that either the earth will not stay still at the centre, or if it does, it will be at rest without having its centre at the place to which it is still its nature to move. †1 Such is the difficulty. [397] A short consideration will give us an easy answer, if we first give precision to our postulate that any body endowed with weight, of whatever size, moves towards the centre. Clearly it will not stop when its edge touches the centre. The greater quantity must prevail until the body's centre occupies the centre. For that is the goal of its impulse. Now it makes no difference whether we apply this to a clod or common fragment of earth or to the earth as a whole. The fact indicated does not depend upon degrees of size but applies universally to everything that has the centripetal impulse. Therefore earth in motion, whether in a mass or in fragments, necessarily continues to move until it occupies the centre equally every way, the less being forced to equalize itself by the greater owing to the forward drive of the impulse. †1

297b14-297b18

[398] If the earth was generated, then, it must have been formed in this way, and so clearly its generation was spherical; and if it is ungenerated and has remained so always, its character must be that which the initial generation, if it had occurred, would have given it.

Lecture 27 (Aquinas' Commentary)

Proof of the earth's spherical shape, from motion.

532. Having determined the truth about the earth's place and about its motion or rest, the Philosopher here determines the truth about its shape.

First he proves that the earth is spherical with natural reasons taken on the part of motion;

Secondly, with mathematical and astronomical reasons based on sense observations (L. 28).

About the first he does two things:

First he shows his proposition with an argument taken from the species of the natural motion of earth;

Secondly, from the figure of its motion (L. 28).

Regarding the first he does three things:

First he presents his reason;

Secondly, he compares it with the reason assigned by the ancients, 534;

Thirdly, he excludes certain objections to the aforesaid reason, at 535.

533. He says therefore first [†393] that it is necessary that the earth have a spherical shape for this reason, namely, that each of its parts "has heaviness toward the middle," i.e., is naturally moved to the middle by its heaviness, as is plain from what has been said above. But we must here consider, with respect to the motion of parts of the earth, that a larger part crowds out a smaller until the larger part reaches the middle. The reason for this is that a larger portion of earth has greater heaviness, and consequently greater power to be moved to the middle, a lesser power being always overcome by a greater. And therefore it is not possible that, as portions of earth are moved to the middle, any part should billow or rise and fall, so that one part of earth should have a position above another, as occurs in the waves of the sea, as though the earth were here not compressed and there compressed. Rather, since all parts of earth tend toward the middle, the upper parts of earth must press down on the lower, and one part, as it were, consent to another by yielding to it, until the middle is reached. And so, as a result, the parts of earth being, as it were, from all sides compressed toward the middle, the earth must have a spherical shape.

534. Then at [†394] he clarifies the foregoing reason by comparing it with the reason others assigned for the shape of the earth. And he says that the foregoing reason must be understood as though one were positing that the earth was newly generated by the parts of earth coming together from all directions to the middle, as the ancient natural philosophers posited. Nevertheless, there is this difference, namely, that whereas they posit that this motion of parts of earth toward the middle is caused by the violence of the heaven's gyration, as was said above, it is better and truer to suppose that this motion of the parts of earth

occurs naturally, on account of the parts of earth possessing heaviness that inclines them toward the middle. If, therefore, we posit that the earth was at first in potency, as the ancients posited, the consequence will be that its parts, at first dispersed and unconnected, will have been borne, when become heavy in act, from every direction to the middle. And from this will result an earth spherical in shape.

p 2-111

535. Then at [†395] he excludes three objections against the foregoing reason. The first of these is that someone can say that the foregoing reason does not force the earth's shape to be spherical, unless one supposes that, during the coming-to-be of the earth, parts of earth from all sides similarly and equally moved together to the middle. But it could have happened that when the parts were still disassociated, more parts of earth were found in one region of the place above than in another; consequently, more parts of earth have been assembled at one part of it than at another — which is against the nature of a spherical shape.

p 2-111

536. But he says that the same results as to the shape of the earth whether the previously disassociated parts of earth come together similarly from the extremities of the earth to the middle or something other is the case. For it is manifest that, if the parts of the earth are carried in a similar fashion and in equal amounts from all directions to the middle, then of course the resulting mass of earth will be everywhere equal — since, because an equal quantity of parts is added to the middle on all sides, necessarily the periphery of the earth will be everywhere equidistant from the middle. And that makes for a sphere, because a sphere is nothing else than a body from the center of which all lines to its surface are equal.

p 2-111

This argument is not affected if someone should insist that the parts do not gather in the middle in a similar way and in equal amounts, since the larger portions, being heavier, always jostle the smaller portions "so far," i.e., until the middle is reached.

p 2-111

Now this can be interpreted in two ways. In one way, as meaning that a less heavy part would be pushed until it reached the middle, by a heavier part. But this does not fit Aristotle's intention, because, on the basis of such an interpretation, there will still remain a greater amount in one region of the earth, where more parts come together.

p 2-111

In another way "so far" can mean, "until the heavier body reaches the middle." And this interpretation is more fitting, because every heavy body naturally tends to this, namely, that it be in its own place, and not that something else be in its own place. Wherefore, a heavier body, in striving to get closer to the middle, violently shoves a less heavy body from the middle — as in the case of a stone thrown into water, which shoves aside the water from contact with the earth.

p 2-111

It is along these lines that Aristotle's reason proceeds. For if a larger quantity of earth finds itself in one section of the earth, then, in order to get closer to the middle, it violently jostles a smaller part from the middle until there is found an equal weight everywhere on the earth.

p 2-111

537. A second objection is excluded at [†396]. First he states it because, as he says, it has the same solution as that which has gone before. The problem is this: Let us suppose that the earth does exist in the

middle, that it is spherical in shape, and that much more quantity is accumulated on one hemisphere of earth than on the other (this is cited in order to exclude an objection that could be raised on account of the mountains, which are seen to rise above other parts of the earth; for the size of mountains is as nothing in comparison with the total quantity of the earth, but is rather like a hair laid on the side of a copper sphere). Now, if we suppose that enough of a heavy body were added to one place so that it would have a notable quantity with respect to the whole earth, the result would be that there would not be the same middle of the world and of the earth. Hence it would follow either that the earth would not be at rest in the middle or if it did rest, without being in the middle, then now, when it is in the middle, it is capable of being in motion. This therefore is the problem.

p 2-112

538. Secondly, he gives the solution at [†397]. And he says that the solution is not difficult to see if someone is willing to consider only slightly and distinguish how we hold that any magnitude having heaviness is borne to the middle of the world. For it is manifest that it will be borne to the middle of the world, not just until its lower surface touches the center of the world, but, unless prevented, it must be borne, with a greater part prevailing over a lesser, to the point where the center of the moved body coincides with the center of the world, in accordance with the inclination that all heavy bodies have. Thus, if the only heavy body in the world were one stone dropped from on high, it would have to keep falling until the center of the stone touched the center of the world. This would be because a greater part of it would repel a lesser from the middle until an equal heaviness should be everywhere found, as was said above.

p 2-112

He concludes therefore that it makes no difference whether we apply this to a clod of earth or to the whole earth. For what has been said about the movement of the heavy to the middle is not due to largeness or smallness; rather, it is verified of everything that has an inclination to the middle by reason of its heaviness. Hence, whether the whole earth is being borne from some part of the heaven to the middle, or parts of it, the motion must continue until earth approaches the center in a similar way from all sides, and this is brought about by the smaller parts being made equal to the larger ones through the displacing of the smaller by the larger, as has been said.

p 2-112

539. The third objection he excludes at [†398]. For someone could say that the foregoing argument proceeds on the assumption that the earth is generated. But this he rejects when he says that, whether the earth was generated, it has to have so come to exist in the middle as has been described, namely, in such a way that its middle touches the middle of the world, and so its figure will be spherical; or whether it was not generated, it must be in the same state as if it had been generated — for the terminus of generation is the nature of the thing; hence anything that is not generated must be such as it would have been had it been generated.

p 2-112

And it is according to this that he concludes the shape of the earth to be spherical.

Lecture 28 (Aristotle's Text)

297b19-298a22

[399] But the spherical shape, necessitated by this argument, follows also from the fact that the motions of heavy bodies always make equal angles, †2 and are not parallel. This would be the natural form of movement towards what is naturally spherical. Either then the earth is spherical or it is at least naturally spherical. †3 And it is right to call anything that which nature intends it to be, and which belongs to it, rather than that which it is by constraint and contrary to nature. [400] The evidence of the senses further corroborates this. How else would eclipses of the moon show segments shaped as we see them? As it is, the shapes which the moon itself each month shows are of every kind — straight, gibbous, and concave — but in eclipses the outline is always curved: and, since it is the interposition of the earth that makes the eclipse, the form of this line will be caused by the form of the earth's surface, which is therefore spherical. [401] Again, our observations of the stars make it evident, not only that the earth is circular, but also that it is a circle of no great size. For quite a small change of position to south or north causes a manifest alteration of the horizon. There is much change, I mean, in the stars which are overhead, and the stars seen are different, as one moves northward or southward. Indeed there are some stars seen in Egypt and in the neighbourhood of Cyprus which are not seen in the northerly regions; and stars, which in the north are never beyond the range of observation, in those regions rise and set. All of which goes to show not only that the earth is circular in shape, but also that it is a sphere of no great size: for otherwise the effect of so slight a change of place would not be so quickly apparent. Hence one should not be too sure of the incredibility of the view of those who conceive that there is continuity between the parts about the pillars of Hercules and the parts about India, and that in this way the ocean is one. As further evidence in favour of this they quote the case of elephants, a species occurring in each of these extreme regions, suggesting that the common characteristic of these extremes is explained by their continuity. [402] Also, those mathematicians who try to calculate the size of the earth's circumference arrive at the figure 400,000 stades. †1 This indicates not only that the earth's mass is spherical in shape, but also that as compared with the stars it is not of great size.

Lecture 28 (Aquinas' Commentary)

p 2-113
Lecture 28

Proofs of the earth's sphericity from the angle of motion of its parts, and from astronomy.
p 2-113
540. Having given an argument for the rotundity of the earth taken from the type of motion of its parts, he here adduces another argument for the same taken from the figure of the motion of the parts of earth.

p 2-113

And he says [†399] that all heavy bodies, from whatever region of the heaven they are moved, are carried to the earth "at like angles," i.e., according to right angles formed by the straight line of the body's motion with a line tangent to the earth (which is evident from the fact that heavy objects do not stand firmly on the earth unless they are perpendicular to it); but heavy bodies are not carried to the earth "side by side," i.e., according to parallel lines. Now all this is ordered to the fact that the earth is naturally apt to be spherical: because heavy bodies have a like inclination to the place of earth no matter from what part of the heaven they are released. And so there is an aptitude for additions to the earth to be made in a like and equal manner on all sides, which makes it to be spherical in shape. But if the earth were naturally wide [flat] in its surface, as some claimed, the motions of heavy bodies from the heaven to earth would not be from all sides at similar angles. Therefore, the earth must either be spherical or be "spherical by nature."

p 2-113

He added this last phrase on account of the bulges of mountains and the depressions of valleys which seem to militate against a rotund earth. But such [deviations] arise from some accidental cause and not from what belongs *per se* to earth; nor does this amount to an appreciable quantity in relation to the whole earth, as has been said above. Now one must say each thing to be as it is according to its nature and not as it is by reason of some violent or preternatural cause. And therefore, although by accident the earth may not be perfectly spherical due to some chance happening, yet, because it is naturally apt to be spherical, it should, absolutely speaking, be called spherical.

p 2-113

541. Then at [†400] he proves that the earth is spherical with astronomical arguments, based on what appears according to sense. And he brings in three proofs. The first of these is taken from the eclipse of the moon. And he says that it is further manifest by what appears according to sense, that the earth is spherical. For unless the earth were spherical, an eclipse of the moon would not always reveal circular segments; for we observe that whenever the moon is eclipsed, its dark and its shining portions are distinguished by a curved line. Now an eclipse of the moon results from its entering the earth's shadow — hence the earth's shadow appears to be round. From this it appears that the earth, which makes such a shadow, is round — for only a spherical body is apt always to cast a round shadow. For if the shining body, namely, the sun is larger than the earth, the earth must make a pyramidical shadow, whose cone is above and base on earth; if the sun should be smaller than the earth, it would likewise produce a shadow according to the figure of a round pyramid [i.e., a cone], but, conversely [the summit of] the cone of this pyramid would be on the earth and its base in the heaven; if the sun were equal to the earth, the shadow made would be cylindrical, i.e., columnar. Now, no matter which of these it should be, it would follow, on account of the earth's sphericity, that its shadow would cut the moon according to a circular line.

p 2-114

Now someone could say that this circular section is not due to the earth's rotundity but to the moon's. But to exclude this he adds that in the monthly waxing and waning of the moon, the section of the moon takes all differences of shape — for sometimes it is divided by a straight line, as when it is divided through the center, for example, on the 7th and the 21st days; at other times, it is *amphicurtos* [gibbous], having a circular or arc-like section, namely from the 7th to the 21st; at still other times it is concave [crescent], as from the 1st to the 7th, and from the 21st to its total waning. All this happens according to its position in relation to the sun, as has been said above. But during eclipses the line dividing the moon is always "gibbous," i.e., circular. Since, therefore, the moon is eclipsed by the interposition of the earth, the rotundity of the earth, since it is spherical, is the cause of such a shape with respect to the division of the moon.

p 2-114

542. The second proof is given at [†401] and is based on the appearance of the stars. And he says that from the difference in the appearance of the stars it appears that the earth is not only round, but also small in comparison with the heavenly bodies. For if we move a slight distance to the south or north, our horizon is noticeably changed.

p 2-114

This change is particularly evident in two respects. First, with respect to the horizon's pole, which is the point of the heaven above our head. This point markedly varies in proportion to a short distance, as is apparent from the fixed stars — since with a slight change of location on our part different stars appear overhead.

p 2-114

Secondly, a difference of horizon appears from the different cutting of the heaven by the horizon. And he shows this from the fact that, as one moves to the north or to the south, the same stars are not visible. To those who live in the oblique sphere, the north pole is above their horizon, and all the stars which are not farther from the pole than the elevation of the pole above the horizon are perpetually visible, while all the stars at an equal distance from the other pole are perpetually hidden. Since, therefore, because of the difference of horizon, in northern lands the north pole is higher, and the opposite pole is lower, it happens that certain stars which are near to the antarctic pole are not perpetually hidden, but are sometimes seen in lands more to the south, for example in Egypt and about Cyprus, which are never seen in the more northerly region. Conversely, certain stars are always visible in the more northern regions, which in more southern regions are hidden by setting.

p 2-114

And from this it appears that the earth is rotund in shape especially according to its aspect at the two poles — for if it were flat, all those dwelling on the whole face of the earth to the south and north would have the same horizon and the very same stars would appear to them and be hidden from them, no impediment arising from the bulge of the earth. And with a similar argument it is proved that the earth is round toward the east and west — otherwise no star would rise any earlier for people in the east than for those in the west. For if the earth were concave, a rising star would appear first to people in the west; but if the earth were flat, it would appear to everyone at the same time. But it is evident that a rising star appears first to those in the east, if we consider a lunar eclipse. If such an eclipse appears in a more easterly region about midnight, it will appear before midnight in a more westerly region, depending on the amount of the distance. From this it is plain that the sun rises earlier and sets earlier in a more easterly region.

p 2-115

This also shows, as Aristotle says, that the earth's rotundity is of no great quantity. For if it were, in so small a distance there would not so soon be made a change in the appearance of the stars. And therefore, we would not consider as very absurd the view of those who wish to link, on the basis of similarity and nearness, the region situated in the far west about the pillars of Hercules (which Hercules set up as a memorial of his victory), and the region in the far east about the Indian Ocean, and who say there is one sea, the Ocean, bordering on both places. And they make a conjecture as to the similarity of both places from the elephants which arise in both places but are not found in the regions between them. This of course is a sign of the agreement of these places but not necessarily of their nearness to one another.

p 2-115

543. He adduces a third proof at [†402], and it is based on measurements of the earth. And he says that whatever mathematicians have attempted to reason about the size of the earth's rotundity assert that its circumference reaches 40 myriads of stades, i.e., 40 times 10,000, which is 400,000 stades. Now a stadium is 1/8 of 1,000 paces. But 1/8 of the aforesaid number is 50,000. Therefore, according to this, the

circumference of the earth will be 50,000 times a thousand paces.

p 2-115

But according to the more careful measurement of present-day astronomers, the earth's circumference is much less, i.e., 20,000 times 1,000 paces and 400, as Al Fargani says; or 180,000 stades, as Simplicius says — which is about the same, since 20,000 is 1/8 of 160,000.

p 2-115

Now astronomers were able to calculate this by considering how much space on earth makes for a difference of one degree in the heaven; and they found that it was 500 stadia according to Simplicius, or 56 2/3 times 1,000 paces according to Al Fargani. Hence, multiplying this number by 360, which is the number of degrees in the heaven, they found the size of the earth's circumference.

p 2-115

And so, from all of this, we can argue that the earth's quantity is not only spherical, but not large in comparison to the sizes of the other stars. For astronomers prove that the sun is 170 times greater than the earth, even though its distance from us makes it seem to be only a foot in diameter. He says, "of the other stars," because of Pythagoras' opinion, who held that the earth is one of the stars. — And with this is terminated the doctrine of Book II.

Lecture 1 (Aristotle's Text)

298a23-298b10

[403] We have already discussed the first heaven and its parts, the moving stars within it, the matter of which these are composed and their bodily constitution, and we have also shown that they are ungenerated and indestructible. [404] Now things that we call natural are either substances or functions and attributes of substances. As substances I class the simple bodies—fire, earth, and the other terms of the series—and all things composed of them; for example, the heaven as a whole and its parts, animals, again, and plants and their parts. By attributes and functions I mean the movements of these and of all other things in which they have power in themselves to cause movement, and also their alterations and reciprocal transformations. It is obvious, then, that the greater part of the inquiry into nature concerns bodies: for a natural substance is either a body or a thing which cannot come into existence without body and magnitude. This appears plainly from an analysis of the character of natural things, and equally from an inspection of the instances of inquiry into nature. [405] Since, then, we have spoken of the primary element, of its bodily constitution, and of its freedom from destruction and generation, it remains to speak of the other two.†1[406] In speaking of them we shall be obliged also to inquire into generation and destruction. For if there is generation anywhere, it must be in these elements and things composed of them.

298b11-298b13

This is indeed the first question we have to ask: is generation a fact or not?

Lecture 1 (Aquinas' Commentary)

p 3-1

ON THE HEAVENS
BOOK III

Lecture 1

What has gone before and what remains to be treated.

p 3-1

544. After determining the question of bodies that are moved circularly, the Philosopher here goes on to determine that of bodies that move in a straight line.

p 3-1

First he prefaces an introduction in which he explains his intention;

Secondly, he pursues his intention (L. 2).

p 3-1

Regarding the first he does two things:

First he establishes continuity with what has gone before by showing what has already been covered;

Secondly, he states what remains to be discussed, at 546.

p 3-1

545. He says therefore first [†403] that in what has preceded he has "gone through," i.e., treated briefly, "the first heaven and the parts," namely, of it. Now we can understand by "first heaven" the whole universe, which is first in perfection, and take as its "parts" the bodies that are moved with circular and with straight motion. In this way it would seem that he is touching also what was determined in the first book. But this interpretation seems to be belied by his next phrase, "and also the stars that are moved in it." Now, the stars are not properly said to be carried along in the whole universe, but in the heaven which is circularly moved. Hence it seems better to understand what he says of the first heaven to refer to the body which is moved circularly.

p 3-1

But because he does not say absolutely "heaven," but "first heaven," this can be referred to the first sphere, which is that of the fixed stars; and "parts" to the right and left and the other different positions that he showed to exist in the heaven. But according to this interpretation there would not be a sufficient recalling, either of what was treated in the entire first book, or of all those things treated in the second, in which the spheres of the planets were also discussed. Consequently, it seems better to say that by "first heaven" is here understood the entire body which is circularly moved, and that it is called "first" in comparison to the

here understood the entire body which is circularly moved, and that it is called "first" in comparison to the lower bodies, in relation to which it is first in the order of position, and by reason of the eternity of its duration, and the power of its causality. The added expression, "and the parts," would then refer to the various spheres which are parts of the whole celestial body.

p 3-1

The stars that are moved in the whole heaven have also been treated, both the fixed stars and the planets. Concerning them it has been stated of what they are composed: for it was shown that they are of the nature of the heavenly body. It has also been stated how they are according to nature, namely, that they are animated and spherical. Likewise it has been said that they are not subject to generation and decay.

p 3-2

If the first book was a discussion of the whole universe, as we have said it was according to the opinion of Alexander, then this present review refers only to the second book. But if his [Aristotle's] intention in the first book also was to talk mainly about the heaven, as Simplicius avers, then this review extends even to the first book.

p 3-2

546. Then at [†404] he shows what remains to be treated.

First he shows in what the entire consideration of natural philosophy consists;

Secondly, from this he concludes what remains to be said, after what has gone before, at 549.

p 3-2

In regard to the first [†404], he uses the following argument: All natural substances are bodies; but the whole consideration of natural science is about natural substances and their accidents; therefore the whole consideration of natural science is concerned with bodies.

p 3-2

547. First, therefore, he presents the minor, saying that among the things said to be according to nature, some are natural substances and some are the operations and passions of natural substances. In order to manifest this, he first explains which are the natural substances. Among these he first numbers simple bodies. And among these he gives as the first examples, fire and earth, and those others that are the elements of bodies together with these, as are air and water. And to the nature of these pertain the mixed [compound] bodies composed of them, such as stones and metals. Then he mentions another body beyond the elements, namely, the whole heaven and its parts. Lastly, he mentions animated composites, such as animals and plants and their parts.

p 3-2

After this he manifests what the operations of these substances are. And he says that first, indeed, are the local motions of each of these bodies and also of the bodies of which these bodies are the cause, either the material cause, as are the elements, or the efficient, as is the heaven (and yet motion suits caused bodies according to the power of the simple bodies out of which they are caused). Then he says that the activities and passions of the aforesaid substances are their alterations and transmutations into one another according to generation and corruption.

p 3-2

Secondly, he infers the conclusion and says that from the foregoing it is plain that most of "natural history" (i.e., the relating of the contents) deals with bodies. In saying "most," he means "all," but he uses

this mode of expression on account of his philosophic temperament. Or he says "most" on account of the fact that in natural science something is also said about the first mover and the intellective soul.

p 3-2

548. Thirdly, he presents the major, namely, that all natural substances are either bodies, or are generated with bodies and magnitudes, as are the natural forms, which are called "substances." And he says that this is evident in two ways: First, from what has just been decided as being according to nature — all of which are either bodies or with bodies; and in *Physics* II it was determined that those things are according to nature which have within themselves their own principle of motion and rest; such things are bodies and only bodies, because only bodies are moved. Secondly, he says that this is manifest by induction, if we consider one by one the things treated in natural science — for we find that all are bodies or with bodies. And it should be noted that he mentioned all this as a preface to Book I.

p 3-3

549. Then at [†405] he states what remains to be discussed. First with regard to substances, saying that the heaven has been discussed, i.e., the first body among the elements, which he calls an "element" because it is a part of the world, according to Alexander; but according to Simplicius because it is a simple body. Concerning the heaven, its condition according to nature has been stated, namely, that it is animated and spherical, and also that it is indestructible and ungenerated. Hence the task which remains is to speak of the other two bodies. For it was shown in the first book that there are three bodies: one, namely, which is in motion around the center — which has already been treated; another, which is moved away from the center; and a third which is moved toward the center. These [last] two still remain to be treated — for the earth was discussed not with respect to its nature, but in its relation to the heaven.

p 3-3

550. Secondly, at [†406] he shows what remains to be said as to activities and passions [properties]. And he says that along with these two it remains to investigate generation and corruption, because either generation is nothing and has no connection with the nature of the entire universe, or it is found only in those elements that are moved with a straight motion and in bodies composed of them. But there was no place for this consideration so long as indestructible bodies were being considered. But this consideration must be taken up first, because it contributes a great deal to the consideration of the nature of bodies.

Lecture 2 (Aristotle's Text)

298b14-299a1

[407] Earlier speculation was at variance both with itself and with the views here put forward as to the true answer to this question. Some removed generation and destruction from the world altogether. [408] Nothing that is, they said, is generated or destroyed, and our conviction to the contrary is an illusion. So maintained the school of Melissus and Parmenides. But however excellent their theories may otherwise be, anyhow they cannot be held to speak as students of nature. There may be things not subject to generation or any kind of movement, but if so they belong to another and a higher inquiry than the study of nature. They, however, had no idea of any form of being other than the substance of things perceived; and when they saw, what no one previously had seen, that there could be no knowledge or wisdom without some such unchanging entities, they naturally transferred what was true of them to things perceived. [409] Others, perhaps intentionally, maintain precisely the contrary opinion to this. It had been asserted that everything in the world was subject to generation and nothing was ungenerated, but that after being generated some things remained indestructible while the rest were again destroyed. This had been asserted in the first instance by Hesiod and his followers, [410] but afterwards outside his circle by the earliest natural philosophers. †1 But what these thinkers maintained was that all else has been generated and, as they said, 'is flowing away', nothing having any solidity, except one single thing which persists as the basis of all these transformations. So we may interpret the statements of Heraclitus of Ephesus and many others. †2[411] And some †3 subject all bodies whatever to generation, by means of the composition and separation of planes.

Lecture 2 (Aquinas' Commentary)

p 3-4
Lecture 2

Opinions of the ancients on the generation of things.
p 3-4
551. Having presented an introduction in which he showed what remains to be considered in natural science, he now undertakes to pursue what has been said.

p 3-4
First by inquiring into the opinions of philosophers on this matter;

Secondly, by determining the truth, in Book IV.

p 3-4

About the first he does two things:

First he inquires into the generation and motion of natural bodies, as to whether it exists;

Secondly, as to which things are generated and moved, and why (L. 8).

p 3-4
Concerning the first he does two things:

First he inquires according to the opinions of early philosophers whether generation is a fact;

Secondly, whether local motion is natural to natural bodies (L. 5).

p 3-4
As to the first he does two things:

First he cites the opinions of the ancients about generation;

Secondly, he investigates the truth of these opinions (L. 3).

p 3-4
Regarding the first he does three things:

First he shows the difference among philosophers as to generation;

Secondly, he presents the opinions that deny generation, at 552;

Thirdly, those that attribute generation to bodies, at 554.

p 3-4
He says therefore first [†407] that those who previously philosophized about the truth, namely, speculative truth (which he says to distinguish them from those who philosophized on morals and on politics), are in their opinions both at variance with one another and with what will now be said about generation.

p 3-4
552. Then at [†408] he presents the opinions of those who remove generation. And he says that certain of the ancient philosophers totally removed generation and decay from things — for they said that nothing in beings comes to be or is destroyed, but something only seems to us to be generated or destroyed. This was the opinion of the followers of Melissus and Parmenides, whom Aristotle in one respect praises and in another condemns. He praises them for being the first to recognize that there have to be natures that are ungenerated and indestructible and immobile. This they were moved to assert for the reason that there cannot be sure knowledge or science about things that are subject to generation and decay. If, then, there is any certain knowledge or science, there must be certain natures which are ungenerated and indestructible. For even if there be some science of the things subject to generation and decay, it is only insofar as there is in them something ungenerated and indestructible, according to a participation in those natures that of themselves are ungenerated and indestructible. For they are known according to their forms, and form is something divine in things, insofar as it is a participation of the first act.

p 3-4
But Aristotle reprehends them because, since they supposed that nothing beyond what can be sensed exists, and yet understood that there have to be certain ungenerated and indestructible substances, they

transferred what belongs to the notion of the substances above nature to these sensible things, stating these sensible things to be in truth ungenerated and indestructible, but to be generated and destroyed according to opinion. But it is manifest that if there are certain ungenerated and indestructible and utterly immobile beings, their study does not pertain to natural philosophy, which is wholly concerned with changeable things, but pertains more to another prior philosophy, which is metaphysics. And therefore Parmenides and Melissus, although they spoke well in one respect, by positing the need for something ungenerated and immobile to exist, nevertheless did not speak well in treating of natural things in a nonnatural way, attributing the qualities of immobile substances to natural substances, which are sensible substances.

p 3-5

553. But Simplicius in his commentary says that Aristotle in his customary way reprehends Parmenides and Melissus for what externally appeared from their words lest anyone, understanding them superficially, should be deceived, but that in fact the intention of these philosophers was that being of itself, i.e., being that exists by its very essence, is ungenerated and indestructible and completely unchangeable. As to their statement that generation and decay are in things only according to opinion and not in reality, this they said because they believed that sensible things, in which generation and decay are found, are not truly beings but only according to opinion.

p 3-5

554. Then at [†409] he presents the opinion of those who attribute generation to bodies, and he gives three opinions. He says that certain others held an opinion contrary to the foregoing, as though purposely intending to contradict them. For some maintain that nothing is ungenerated but that all things are generated, and that among these some remain indestructible and others are destroyed. Such was the doctrine especially of the followers of Hesiod, one of the Theologizing Poets, who treated divine matters under the guise of fables. Hence Hesiod is said to have posited even chaos, from which all things are generated, to have been generated. But whatever is generated is generated by some generator. Hence they gave it out that over all those things there is a certain first cause, namely, an intellect and a divinity, from which all things proceeded. Such a procession of all things from the first principle they called "generation."

p 3-5

555. The second opinion is given at [†410]. And he says that after the aforesaid poets, among others who first treated of nature, were those who maintained that all other things are generated and remain in a state of continuous flux, so that nothing is fixed and permanent in things except one, namely, the material principle which underlies all things that come to be and decay. This same thing was maintained by many other philosophers — such as Thales, who proposed that water is this first principle; and Anaxagoras, air; but Anaximander, an intermediate between the two, namely, vapor. Heraclitus of Ephesus proposed fire (and is specially mentioned because he more than others asserted all things to be in continual flux).

p 3-5

556. The third opinion he gives at [†411]. And he says that there are some who maintained every body is generable because they posit that all bodies are composed of surfaces and are reducible to surfaces. This was Plato's opinion.

Lecture 3 (Aristotle's Text)

299a2-299b14

[412] Discussion of the other views may be postponed. †4 But this last theory which composes every body of planes is, as the most superficial observation shows, in many respects in plain contradiction with mathematics. It is, however, wrong to remove the foundations of a science unless you can replace them with others more convincing. [413] And, secondly, the same theory which composes solids of planes clearly composes planes of lines and lines of points, so that a part of a line need not be a line. This matter has been already considered in our discussion of movement, where we have shown that an indivisible length is impossible. †1[414] But with respect to natural bodies there are impossibilities involved in the view which asserts indivisible lines, which we may briefly consider at this point. For the impossible consequences which result from this view in the mathematical sphere will reproduce themselves when it is applied to physical bodies, but there will be difficulties in physics which are not present in mathematics; for mathematics deals with an abstract and physics with a more concrete object. [415] There are many attributes necessarily present in physical bodies which are necessarily excluded by indivisibility; all attributes, in fact, which are divisible. †2 There can be nothing divisible in an indivisible thing, but the attributes of bodies are all divisible in one of two ways. They are divisible into kinds, as colour is divided into white and black, and they are divisible *per accidens* when that which has them is divisible. In this latter sense attributes which are simple †3 are nevertheless divisible. Attributes of this kind will serve, therefore, to illustrate the impossibility of the view. [416] It is impossible, if two parts of a thing have no weight, that the two together should have weight. But either all perceptible bodies or some, such as earth and water, have weight, as these thinkers would themselves admit. Now if the point has no weight, clearly the lines have not either, and, if they have not, neither have the planes. Therefore no body has weight. [417] It is, further, manifest that their point cannot have weight. For while a heavy thing may always be heavier than something and a light thing lighter than something, a thing which is heavier or lighter than something need not be itself heavy or light, just as a large thing is larger than others, but what is larger is not always large. A thing which, judged absolutely, is small may none the less be larger than other things. Whatever, then, is heavy and also heavier than something else, must exceed this by something which is heavy. A heavy thing therefore is always divisible. But it is common ground that a point is indivisible. [418] Again, suppose that what is heavy is a dense body, and what is light rare. Dense differs from rare in containing more matter in the same cubic area. A point, then, if it may be heavy or light, may be dense or rare. But the dense is divisible while a point is indivisible. [419] And if what is heavy must be either hard or soft, an impossible consequence is easy to draw. For a thing is soft if its surface can be pressed in, hard if it cannot; and if it can be pressed in it is divisible.

299b15-299b23

[420] Moreover, no weight can consist of parts not possessing weight. For how, except by the merest fiction, can they specify the number and character of the parts which will produce weight? [421] And, further, when one weight is greater than another, the difference is a third weight; from which it will follow that every indivisible part possesses weight. For suppose that a body of four points possesses weight. A body composed of more than four points †1 will be superior in weight to it, a thing which has weight. But the difference between weight and weight must be a weight, as the difference between white and whiter is white. Here the difference which makes the superior weight heavier †2 is the single point which remains when the common number, four, is subtracted. A single point, therefore, has weight.

Lecture 3 (Aquinas' Commentary)

p 3-6

Lecture 3

Bodies not generated from surfaces — proved mathematically and naturally.

p 3-6

557. Having presented the opinions on the generation of things, he now inquires into the truth of the aforesaid opinions. And passing by the other opinions, which he discussed in other places, he makes inquiry especially about the last one, which is Plato's, both because it was more famous, and because in the order of inquiry it was prior. For the other opinions posited or removed generation of special bodies; but this opinion seemed to teach the generation of body insofar as it is body, since it posits body to be generated from surfaces.

p 3-6

In regard to this he does two things:

First he disproves this opinion;

Secondly, he shows that the same arguments can disprove the opinion of the Pythagoreans, who posit that bodies are generated from numbers, at 574.

p 3-6

As to the first he does two things:

First he disproves the aforesaid opinion with mathematical arguments;

Secondly, with natural arguments, at 560.

p 3-6

558. As to the first he gives two arguments. With respect to the first of these he says [†412] that a discussion of the other opinions should be held elsewhere: partly, indeed in *Physics* I, partly in the book *On Generation,* and partly in a later section of the present book. But as to those who posit that all bodies are constituted of surfaces, it is possible at once to see that they are found to hold many things contrary to the "disciplines," i.e., the mathematical sciences. These suppose that a point is indivisible, and that, consequently, a line, which is divisible, is not made of points. Mathematics supposes, too, that a line is a length without breadth; consequently, a surface does not come to be from lines, because it has length and width without depth. Thus, too, neither does a body come from surfaces, since a body has length and width and depth. But it is not correct for anyone to reject these suppositions of the mathematicians, unless he can present arguments more probable than the suppositions. Consequently, the opinion of Plato seems to deserve to be disapproved, on the ground that he removes mathematical suppositions without a strong enough reason.

p 3-6

559. The second argument is at [†413]. And he says the reason is the same for solids, i.e., bodies, to be composed of surfaces, and surfaces composed of lines, and lines of points, because, just as the point is the terminal and divider of the line, so the line is of the surface and the surface of the body. But if what Plato says is true, namely, that bodies are composed of surfaces, it will follow that a surface is composed of lines and lines of points. Consequently, it will not be necessary that a part of a line be a line. This matter, he says, was previously considered in "the discussions on motion," i.e., in *Physics* VI, where it was proved that lines are not indivisible, and are not composed of indivisibles. There is also found a certain other short book in which it is proved that lines are not indivisible, said by some to be by Theophrastus.

p 3-6

560. Then at [†414] he disproves the aforesaid opinion with natural arguments.

First he states why it is necessary to present such arguments, i.e., not only mathematical, but also natural;

Secondly, he pursues his plan, at 561.

p 3-7

He says therefore first [†414] that, because we have said that an impossibility in mathematics follows upon the assumption by some of indivisible lines, from which surfaces are composed, and consequently bodies, it is also necessary to consider now briefly the impossibilities affecting natural bodies that will follow from this assumption. The reason this is necessary is that whatever impossibilities affect mathematical bodies must, as a consequence, extend to natural bodies. And this is so because mathematical things are obtained by abstraction from natural things, but natural things are by apposition to mathematical things — for they add to mathematical objects a sensible nature and motion, from which mathematics abstracts. Thus it is clear that mathematical properties are saved in natural things, but not conversely. Therefore, whatever impossibilities are against mathematical things are also against natural things, but not vice versa.

p 3-7

561. Then at [†415] he shows what impossibilities affecting natural bodies flow from the aforesaid position.

First he presents a certain general argument;

Secondly, he explains it part by part, at 562.

p 3-7

He says therefore first [†415] that there are many things which must exist in natural bodies but cannot exist in indivisibles. We could take "indivisibles" here as "mathematical things" on the ground that they are said by abstraction; thus what is said here will be adduced to show what was just said, namely, that natural things are by apposition to mathematical, since many things must be present in natural things that cannot be present in mathematical things, such as all the passions [properties] that are divisible. But it is better to take "indivisibles" as surfaces with respect to bodies, and lines with respect to surfaces, and points to lines — which latter are indivisible absolutely.

p 3-7

He says therefore that many things must be present in natural bodies that cannot be present in indivisible things: "For example, if something is indivisible," such as a point or line or surface; or, "for example, if something is divisible" — because what is divisible is of necessity in a natural body, but not in things that are indivisible. For something divisible cannot exist at all in an indivisible thing — since what is in

something is in a certain way comprehended by it: but the divisible cannot be comprehended by the indivisible according to quantity. All passions are divided in two ways: either according to species, or according to accident. This of course does not mean that each and every passion is divided in both ways, but that each is divided in one way or the other.

p 3-7

He then explains both ways of division. And he says that a passion is divided "according to species" in the way that the species of color are white and black. This can be understood in two senses. In one way, in the sense that this common thing which is color is divided into black and white, as though by its species; but this contributes nothing to our argument, because there is nothing to prevent something common to many from being predicated of some indivisible. Consequently, we must understand a passion divisible according to species in the sense of an intermediate color, which is a composite of two species of color, namely, black and white. Now it does not seem that such a passion can exist in a thing that is entirely simple: because, since the proper passions are caused by the subject, the principles of a composite passion must be diverse, and diversity is repugnant to the simplicity of a subject.

p 3-8

Then he explains what is divisible "according to accident." And he says that a passion is said to be divisible according to accident, if the subject of which it is an accident is divisible, as white is divided by dividing its subject. Hence all passions that are simple according to species are divisible in this way, i.e., according to subject, insofar, namely, as they exist in a natural subject.

p 3-8

And therefore, regarding such passions which are divisible in one way or the other, it is to be understood that an impossibility follows upon those saying lines to be indivisible or surfaces, from which natural bodies are composed, namely, out of such things which cannot be the subject of the passions of natural bodies.

p 3-8

562. Then at [†416] he gives special arguments which disprove the aforesaid position. In regard to the first argument he does two things:

First he presents the argument;

Secondly, he proves what he had supposed, at 563.

p 3-8

He says therefore first [†416] that it is impossible, if neither of the things out of which something is composed has heaviness, that the composite of both have heaviness. But sensible bodies have heaviness: either all of them, as Democritus says, or some, namely, earth and water, as the Platonists said. Therefore, a sensible body cannot be composed of things not having heaviness. But a point has no heaviness; therefore, a thing with heaviness cannot be composed of points. Yet according to the aforesaid opinion, a line is composed of points. Therefore, a line also cannot have heaviness. Consequently, neither can a surface, which is composed of lines; furthermore, neither can a body, which is composed of surfaces — which is against the aforesaid.

p 3-8

It should be noted that this argument holds for quantitative parts which are of the same nature and notion both in relation to one another and to the whole; but it does not hold in essential parts, which have a different notion with respect to one another and with respect to the whole. Hence it does not follow, if

matter is not heavy and form is not heavy, that the composite is not heavy — because matter is heavy in potency, but through form something is made actually heavy.

p 3-8

563. Then at [†417] he proves what he had assumed in the preceding argument.

First he proves that a point is not heavy;

Secondly, that something heavy cannot be from non-heavy things, at 566.

p 3-8

The first he proves with three arguments, the first of which is this: Every heavy thing can be heavier than some other, and every light thing can be lighter than something else; but yet it is not necessary that everything heavier or lighter be heavy or light.

p 3-8

Now what he says here seems to be false: for the comparative presupposes the positive — everything whiter is white.

p 3-8

Some therefore say that the comparative, if taken in its proper sense, does suppose and imply the positive; but that sometimes the comparison is "abusive." This occurs, for example, when a thing is said comparatively with respect to an opposite, as when a swan is said to be "whiter" than a raven, or even when a thing is described in the comparative degree because it possesses less of the opposite, as when an Ethiopian is said to be "whiter" than a raven because he is less black, or when it is said that some lesser evil is "more worthy of choice" than a greater evil — whereas evil is not worthy of choice, and an Ethiopian is not white. And it is in this way that the Philosopher here says that not everything heavier is heavy, nor everything lighter light. Hence, to designate an "abusive" comparison, he added, "perchance."

p 3-9

But since it is not Aristotle's custom to argue from "abusive" terms, it therefore should be stated that there are some things which are described only absolutely, as in the case of white or sweet; and in such cases the comparative presupposes the positive, and implies it. But there are other things which are sometimes said absolutely and sometimes relatively — as in the case of heavy and light: for, as will be said in Book IV, fire is said to be absolutely light and earth absolutely heavy; but air is heavy to fire, while light to water and earth. So too, water is light to earth but to air and fire heavy. Now it is evident that what is absolutely heavy, is also heavy when compared to other things; and that which is absolutely light, is light compared to other things. In this sense, everything heavy is heavier and everything light is lighter. But it does not follow that everything heavier is heavy, and everything lighter is light — since it does not follow that, if something is light in relation to other things, that it is light absolutely; and the same goes for the heavy.

p 3-9

That this is the explanation of the statement is plain from the example he gives. For "large," taken commonly, is relative, as is evident in the *Predicaments,* but as applied to some thing, that is called "large" absolutely which attains to the quantity due it — as a man is called "large" absolutely, who attains to the perfect quantity of a man. Thus it is plain that "large" is said absolutely and relatively. Hence everything "large" absolutely is said to be large in relation to something, and this is to be "larger"; but not everything described as "larger" is large absolutely, for there are many things which, absolutely considered, are small, and yet are larger than other things.

Therefore, if everything heavy is heavier than something else, then necessarily everything heavy must be greater in heaviness than something else. And so it follows that it is divisible: for everything that is greater is divided into what is equal and something more. But a point is indivisible, as is supposed from its definition. Therefore a point is not heavy.

564. The second argument is given at [†418], as follows: Heavy and light follow upon rare and dense — for we see that according to rarity and density, elements differ in heaviness and lightness. But the dense differs from what is rare in that, "in an equal mass," i.e., under the same dimensions, it contains more, because it has more matter, as is had in *Physics* IV. But since some bodies are heavy and some light, then if a point is posited as heavy, it is with equal reason posited as light; and if it is posited as dense, it is with equal reason posited as rare. But what is posited as dense must be divisible, insofar as it contains more under a smaller mass; similarly, what is rare must be divisible, insofar as it contains an equal amount under greater dimensions. But a point is indivisible. Therefore, it is neither thick nor rare and, consequently, neither heavy nor light.

565. The third argument is given at [†419], as follows: Whatever is heavy is either soft or hard: the reason being that heaviness follows on two elements, namely, earth and water, one of which, namely, water, yields to the touch and is, accordingly, a principle of softness, while the other, namely, earth, does not yield and is a principle of hardness. Now it is obvious that everything soft is divisible, because it yields within itself to what touches it. But this could not happen unless it had a number of parts, one of which is able in some way to move into the place of another. For the same reason, what is hard must be divisible, for it could not be said to be "unyielding," unless it had whence it could yield. Consequently, since a point is indivisible, it will be neither hard nor soft, and, therefore, not heavy.

566. Then at [†420] he shows that nothing heavy can be composed of two or more things, none of which is heavy. But this must be understood of the composition by which something is composed of quantitative parts — for something heavy is composed of essential parts, for example, of matter and form, neither of which is heavy.

To prove this he presents two arguments. The first of these proceeds in accordance with the opinion of some who said that from certain things not heavy, when they were multiplied, something heavy was composed, but that when they were in a lesser number, nothing heavy was made of them. But those who present this opinion must determine how many such things are required to form heaviness; otherwise what is said without a sure reason is seen as fictitious.

567. The second argument is presented at [†421], as follows: Every heaviness greater than another heaviness exceeds the lesser by a certain heaviness, because something is made greater by the addition of like things. From this it follows, according to the aforesaid position, that every indivisible has heaviness. For let us suppose a body constituted of four points, having heaviness; let us take another body made of more points, say five. Thus it will be heavier — and in such a way that that by which it is heavier, must be heavy. And although not everything heavier is heavy, as was said above, yet whatever is heavier than something heavy must be heavy, just as everything which is whiter than something white must be white. And therefore, since what is greater by one point is heavier than a body which is equal to it if that point be removed, it will follow that one point is heavy. But that is impossible, as is clear from what has gone

before. Therefore, it remains that it is impossible for something heavy to be made from things that are not heavy.

Lecture 4 (Aristotle's Text)

299b24-300a19

[422] Further, to assume, on the one hand, that the planes can only be put in linear contact †1 would be ridiculous. For just as there are two ways of putting lines together, namely, end to end and side by side, so there must be two ways of putting planes together. Lines can be put together so that contact is linear by laying one along the other, though not by putting them end to end. †2 But if, similarly, in putting the planes together, superficial contact is allowed as an alternative to linear, that method will give them bodies which are not any element nor composed of elements. †3[423] Again, if it is the number of planes in a body †4 that makes one heavier than another, as the *Timaeus* †5 explains, clearly the line and the point will have weight. For the three cases are, as we said before, analogous. †6 But if the reason of differences of weight is not this, but rather the heaviness of earth and the lightness of fire, then some of the planes will be light and others heavy (which involves a similar distinction in the lines and the points); the earth-plane, I mean, will be heavier than the fire-plane. [424] In general, the result is either that there is no magnitude at all, or that all magnitude could be done away with. For a point is to a line as a line is to a plane and as a plane is to a body. Now the various forms in passing into one another will each be resolved into its ultimate constituents. It might happen therefore that nothing existed except points, and that there was no body at all. [425] A further consideration is that if time is similarly constituted, there would be, or might be, a time at which it was done away with. For the indivisible now is like a point in a line. [426] The same consequences follow from composing the heaven of numbers, as some of the Pythagoreans do who make all nature out of numbers. For natural bodies are manifestly endowed with weight and lightness, but an assemblage of units can neither be composed to form a body nor possess weight. [[427] It is plain from the foregoing that it is erroneous to hold either that all things are generated or that nothing is generated. (Ed. note: this sentence does not appear in the 1930 Oxford translation of *The Works of Aristotle,* nor in the 1941 Random House edition of *The Basic Works of Aristotle*.)]

Lecture 4 (Aquinas' Commentary)

p 3-11
Lecture 4

Other natural arguments against Plato's opinion. Pythagorean opinion refuted.

p 3-11

568. Having given a first argument against Plato's opinion that bodies are generated from surfaces, Aristotle here presents a second argument.

p 3-11

To understand this argument it should be known that Plato, because he did not distinguish between the "one" which is the principle of number, and the "one" which is convertible with being, which signifies the substance of the thing, posited as a consequence that the "one" which is the principle of number is the substance of a thing, and consequently, that all things are numbers. Accordingly, he posited the dimensions of continuous quantity to be certain numbers "having position." According to him, therefore, a point is unity having position, and so for all the others. And because he attributed duality to matter and unity to form, he estimated that the forms of all bodies should be taken according to the notion of the figures according to which the bodies are terminated. Now the ultimate terminations of dimensions are points, which are "positioned unities," as has been said. Therefore he attributed the various bodily figures to the various bodies: such as that of the pyramid to fire, that of eight bases [faces, in this case, the octohedron] to air, a figure of 20 bases [the icosahedron] to water, the cube to earth, a 12-based figure [the dodecahedron] to the aether, i.e., to the heaven. Now it is clear that bodily figures are constituted of surfaces, insofar as they are conjoined according to contact along lines — thus constituting corporeal angles. And therefore, assigning the formal composition to bodies, Plato said that bodies are composed of surfaces joined along a line.

p 3-11

569. Against this, therefore, Aristotle objects [†422], and says that an impossibility follows, if it is assumed that surfaces are composed or joined to form a body by mere linear contact.

p 3-11

This he manifests with the example of a line. For a line can be joined to another line in two ways: One way is according to length, and which is according to contact by point, insofar, namely, as the length of one line is joined to the length of another at a point, whether it makes an angle with it or not. The other way is according to width, which consists in adding one whole line to another whole line in the direction of width. Similarly, surface must be joined to surface in two ways: namely, according to depth — for example, if one whole surface should be placed under another; and according to linear contact, whether they form a corporeal angle or not. To explain further what he says, he adds that line can be joined to line by being placed under it, and not only as being added to it according to linear contact [at a point].

p 3-11

570. Therefore, because there are two ways in which surfaces can be joined and because it is according to one way, namely, according to linear contact, that joined surfaces form all the elements, it will follow that, if they should be joined "in the direction of width," i.e., by placing one surface under another, the resultant of surfaces so composed will be a body that is neither an element nor composed from elements. That it is not an element is plain, since all the elements are constituted according to the other mode of conjunction of surfaces. That it is not made from elements is plain, since this combination of surfaces, resulting from superposition, seems to cause a body's depth, which is its substance, while the other combination of surfaces establishes the body with respect to figure, which is a form added to bodily substance. Hence the combination according to sub-position will be prior, and what results from this composition seems to be compared to what results from the other kind of composition, as matter is compared to form. But according to the opinion of Plato, a body's nature is to be composed of surfaces [in linear contact]. It follows, therefore, that what precedes all the elements, as though it were their matter receiving all their figures, or forms, is a body. And Plato regarded this as something unacceptable — for he did not state the first matter

to be a body, as certain of the early natural philosophers did.

p 3-12

571. Then at [†423] he presents a third argument, as follows: Since bodies are constituted out of surfaces, some of which bodies are heavier than others, this can come about in two ways. One way is that a body would be made heavier from the fact that it is composed of more surfaces, as is said in the *Timaeus*. And from this it will follow that surfaces are heavy — because an excess in heaviness cannot be produced except by something that is itself heavy, as was said above. And from this it will further follow that lines and points have heaviness — for these are proportionately related, that is, as surfaces are to bodies, so lines are to surfaces and points to lines. But that points should have heaviness has been disproved above.

p 3-12

The other way is that heavy bodies do not differ from light in this way, i.e., by the multiplication of surfaces, but on account of earth's being composed of heavy [surfaces] and fire of light. And thus it will follow that some surfaces are light and some heavy, and the same for lines and points — because a surface of earth will be heavier than one of fire. And so the same impossibility will arise as before.

p 3-12

572. Then at [†424] he presents a fourth argument, saying that according to the position of Plato it follows that no magnitude exists, or that every magnitude can be "taken away," i.e., cease to exist. For point is to line as line is to surface and surface to body. Consequently, if a body is composed of surfaces, it will be able to be reduced to surface, and, by the same token, all magnitudes will be reduced to the "first things," i.e., to points. Thus it would follow that there would be no body but points only. Nor is it similar if one should wish to argue that it can occur that there be no mixed [composite] bodies, since they can be resolved into the elements out of which they are composed — since such bodies are subject to the heavenly bodies, which produce a mixture in them. But points are not subject to any higher principles which would induce in them the necessity of composition.

p 3-12

573. Then at [†425] he presents a fifth argument, saying that if time is such as to be composed of instants, in the same way as a body is of surfaces, or a line of points (all of which involve the same notion, as is proved in *Physics* VI), it follows that time too can be entirely destroyed by being reduced to its indivisibles — for the "now" is the indivisible of time, just as the point is the indivisible of line.

p 3-12

574. Then at [†426] he assimilates the foregoing position to that of the Pythagoreans. And he says that the same irreconcilable factors follow for those who claim that the heaven is constituted from numbers. For some Pythagoreans posited that all nature is constituted from numbers for the aforesaid reason, and Plato followed them. But now the Philosopher disproves this: For natural bodies have heaviness and lightness. But units joined one to another cannot form a body that is continuous; rather they form something discrete. Nor do they possess heaviness, because they abstract from position, and, consequently, from place.

p 3-12

Finally, in summary he concludes [†427] that there is neither generation of all things nor of none. That it is not of none is evident to sense. But that it is not of all things is plain from the fact that it is impossible for there to be generation of every body — which would indeed be the case if a body were generated from surfaces.

Lecture 5 (Aristotle's Text)

300a20-300b16

[428] The necessity that each of the simple bodies should have a natural movement may be shown as follows. [429] They manifestly move, and if they have no proper movement they must move by constraint: and the constrained is the same as the unnatural. Now an unnatural movement presupposes a natural movement which it contravenes, and which, however many the unnatural movements, is always one. For naturally a thing moves in one way, while its unnatural movements are manifold. †1[430] The same may be shown from the fact of rest. Rest, also, must either be constrained or natural, constrained in a place to which movement was constrained, natural in a place movement to which was natural. Now manifestly there is a body which is at rest at the centre. If then this rest is natural to it, clearly motion to this place is natural to it. If, on the other hand, its rest is constrained, what is hindering its motion? Something, perhaps, which is at rest: but if so, we shall simply repeat the same argument; and either we shall come to an ultimate something to which rest where it is is natural, or we shall have an infinite process, which is impossible. The hindrance to its movement, then, we will suppose, is a moving thing—as Empedocles says that it is the vortex which keeps the earth still—: but in that case we ask, where would it have moved to but for the vortex? †2 It could not move infinitely; for to traverse an infinite is impossible, and impossibilities do not happen. So the moving thing must stop somewhere, and there rest not by constraint but naturally. But a natural rest proves a natural movement to the place of rest. [431] Hence Leucippus and Democritus, who say that the primary bodies are in perpetual movement in the void or infinite, may be asked to explain the manner of their motion and the kind of movement which is natural to them. [432] For if the various elements are constrained by one another to move as they do, each must still have a natural movement which the constrained contravenes, and the prime mover must cause motion not by constraint but naturally. If there is no ultimate natural cause of movement and each preceding term in the series is always moved by constraint, we shall have an infinite process.

Lecture 5 (Aquinas' Commentary)

p 3-13
Lecture 5

Natural motion in natural bodies. Leucippus and Democritus.
p 3-13
575. After disproving the position of those who posit that all bodies are generated from surfaces, the Philosopher here begins to inquire whether natural bodies have natural motions. Concerning this he does

two things:

First he shows that natural bodies have natural motions;

Secondly, how compulsory motions of bodies take place in ways other than those of natural motions, at 590 (L. 7).

p 3-13
As to the first he does two things:

First he shows that natural bodies have natural motions;

Secondly, that they have heaviness and lightness by which they are inclined to their natural motions (L. 7).

p 3-13
Regarding the first he does two things:

First he proves that natural bodies have natural motions;

Secondly, he refutes the opinions of certain philosophers, in error on this matter, at 578.

p 3-13
In regard to the first he does two things:

First he proposes what he intends [†428] and says that because it was said above that the operations and passions of bodies are their generations and motions, and we have already inquired about the generation of bodies, it remains to discuss their motions. And he says it is manifest from what will be said that there must be some natural motion in all simple bodies, whereas mixed bodies follow the motion of the simple body that is predominant in it. Therefore, some natural motion is in every natural body.

p 3-13
576. Secondly, at [†429] he proves his proposition with two arguments, the first of which is based on motion. For we see by the senses that simple bodies are moved; if, therefore, they do not have a proper motion natural to them, then they must be being moved by violence. But to be moved by violence is the same as to be moved beside nature — for what is according to nature is not violent, because the violent is that in which *what undergoes the force contributes nothing,* as is said in *Ethics* III.

p 3-13
Now from the fact that there are motions beside nature, it follows that there is motion according to nature in respect to which a violent motion is called "beside nature" [praeter naturam]; for sickness would not be a disposition beside nature, unless health were a disposition according to nature, because every privation presupposes something positive. And although from the fact that there is a motion beside nature, it follows that there is a motion according to nature, yet, while there are many motions beside nature, the motion according to nature is one, i.e., for one body, because the nature of one thing is determined to one, from which many deviations are possible, just as health is one but sicknesses many. The reason for this is that each thing is "absolutely" according to its nature, i.e., in one way, because the nature of one thing is one; but each thing has not only many motions, but also many dispositions, beside nature.

p 3-13
But against this seems to be the statement made in the beginning of this book, namely, that to a motion according to nature there is contrary to it one beside nature, and that one thing is contrary to one.

p 3-14

To this it can be said that the Philosopher is speaking there of simple motions: for one body cannot be moved beside nature with several simple motions, although it can be moved beside its nature by several composite motions. Or it can be said that even though one thing is contrary to one, yet the contrary which is as privation can occur in many ways, just as health is something absolutely, but sickness can occur in many ways. Similarly, motion according to nature occurs in one way, but beside nature in many ways.

p 3-14

577. The second argument is presented at [†430] and is based on rest. It presupposes two things. First of all, that whatever is at rest must be resting either according to violence or according to nature. Secondly, a thing rests through violence in a place whither it is moved through violence; but wherever it is moved according to nature, it rests according to nature.

p 3-14

From these suppositions he argues thus: It is evident to our senses that some body, for example, earth or a stone, is at rest in the middle. Therefore, according to what has been premised, it is resting either through violence or according to nature. If according to nature, then, according to the suppositions, it follows that the motion of such a body to this place is natural. But if it is resting through violence, then something must be present exerting violence upon it and preventing it from being moved. But what is so preventing it from being moved is itself either in motion or at rest.

p 3-14

If it is at rest, as a pillar at rest prevents a stone upon it from being moved, the same question returns about this impediment: Is it at rest naturally or violently? If naturally, it will be concluded that it is also moved naturally; but if violently, it will in turn need something preventing it. Consequently, it is necessary either to arrive at some first thing at rest according to nature, which will consequently be moved according to nature, or to go on infinitely in bodies — which is impossible, as was shown in Book I.

p 3-14

But if it be said that a thing at rest by violence in the middle is prevented from being moved by something in motion (as Empedocles said that the earth is at rest, being prevented by violence from moving by the gyration of the heaven) then, if that obstacle were removed, the consequence would be that the previously impeded body would be carried to some definite place — it being impossible for it to be carried *ad infinitum,* since it is impossible for the infinite to be traversed, and nothing can be in the process of becoming which cannot come to be. If then it is being moved to some definite place, then, when it shall have arrived there, it will stop or rest there not violently but naturally. And so, according to the premises, if it rests naturally in this place, it follows that it is moved naturally to this place. Consequently, there will exist some natural motion.

p 3-14

578. Then at [†431] he disproves the opinions of certain philosophers on this matter.

First the opinion of Democritus;

Secondly, the opinion of Plato (L. 6).

p 3-14

In regard to the first he does two things. First, from the premises he concludes to the inadequacy of Democritus' sayings. For he posited that the indivisible bodies which he said to be principles are always

being moved in an infinite and empty space. But it has been shown that simple bodies have some natural motion. Therefore they should decide by what kind of motion such bodies are being moved and what their natural motion is. However, since they have not determined this, their doctrine is incomplete.

p 3-15

579. Secondly, at [†432] he presents a certain excuse, because they said that one of those indivisible bodies which they posited as elements is moved violently by another.

p 3-15

But he rejects this on two grounds. First, because if violent motion is posited, then natural motion must be posited, beside which the violent motion is, as was said above. Secondly, because at least the first mover must not cause motion through violence but according to nature. For whatever causes motion through violence has the principle of its motion without, and thus does not move except as moved. If then a first thing causing motion by nature is not posited, but always one that is acting through violence being previously moved by something else, there will be an infinite process in movers — which is impossible, as was proved in *Physics* VIII. Therefore they are not excused from the need for positing natural motion.

Lecture 6 (Aristotle's Text)

300b17-301a20

[433] The same difficulty is involved even if it is supposed, as we read in the *Timaeus*, †1 that before the ordered world was made the elements moved without order. Their movement must have been due either to constraint or to their nature. And if their movement was natural, a moment's consideration shows that there was already an ordered world. For the prime mover must cause motion in virtue of its own natural movement, †2 and the other bodies, moving without constraint, as they came to rest in their proper places, would fall into the order in which they now stand, the heavy bodies moving towards the centre and the light bodies away from it. But that is the order of their distribution in our world. [434] There is a further question, too, which might be asked. Is it possible or impossible that bodies in unordered movement should combine in some cases into combinations like those of which bodies of nature's composing are composed, such, I mean, as bones and flesh? Yet this is what Empedocles asserts to have occurred under Love. 'Many a head', says he, 'came to birth without a neck.' †1[435] The answer to the view that there are infinite bodies moving in an infinite is that, if the cause of movement is single, they must move with a single motion, and therefore not without order; and if, on the other hand, the causes are of infinite variety, their motions too must be infinitely varied. For a finite number of causes would produce a kind of order, since absence of order is not proved by diversity of direction in motions: indeed, in the world we know, not all bodies, but only bodies of the same kind, have a common goal of movement. [436] Again, disorderly movement means in reality unnatural movement, since the order proper to perceptible things is their nature. And there is also absurdity and impossibility in the notion that the disorderly movement is infinitely continued. For the nature of things is the nature which most of them possess for most of the time. Thus their view brings them into the contrary position †2 that disorder is natural, and order or system unnatural. But no natural fact can originate in chance. [437] This is a point which Anaxagoras seems to have thoroughly grasped; for he starts his cosmogony from unmoved things. The others, it is true, make things collect together somehow before they try to produce motion and separation. But there is no sense in starting generation from an original state in which bodies are separated and in movement. Hence Empedocles begins after the process ruled by Love: for he could not have constructed the heaven by building it up out of bodies in separation, making them to combine by the power of Love, since our world has its constituent elements in separation, and therefore presupposes a previous state of unity and combination. †3

301a21-301a22

[438] These arguments make it plain that every body has its natural movement, which is not constrained or contrary to its nature.

Lecture 6 (Aquinas' Commentary)

n 3-16

Lecture 6

Refutation of Plato's opinion of disordered motion before the world.

580. After disproving the opinion of Democritus and Leucippus on the motions of natural bodies, the Philosopher here disproves Plato's opinion on the same matter.

First with arguments;

Secondly, with the saying of other philosophers, who are seen to have had better perception on this matter, at 585.

581. Regarding the first he presents four arguments, with respect to the first of which he says [†433] that the same impossibility that happens to Democritus and Leucippus must recur, if anyone posits that before the world was made the elements out of which it is formed were being moved with a disorderly motion, as Plato writes in the *Timaeus,* recounting that, before the world was made by God, matter fluctuated without order.

That the same impossibility recurs when this is posited he proves by adding that the disorderly motion by which the elements were being moved was either violent or according to nature. If violent, we are led back to the first position: hence the same impossibility recurs. But if the motion were according to nature, then we are contradicting our assumption. For it is assumed that the world was not yet existing, whereas, if the elements were being moved according to nature, then it is necessary to say the world was already existing, if one wishes to consider attentively. For since every motion, even according to Plato, is reduced to a first mover as to its cause, then, if the elements were in some way moved, it must be said that the first mover was moving himself according to nature.

By first mover is here understood, not the absolutely first mover, which is utterly immobile, as is proved in *Physics* VIII and in *Metaphysics* XII, but the first mover in the genus of natural movers, i.e., one that moves itself and is composed of mover and moved, as was proved in *Physics* VIII. But if we follow another reading, namely, "the first mover must move the (first) moved according to nature," then it refers to the first mover moving absolutely, which is wholly immobile, which moves the first mobile.

But no matter how "first mover" is understood, it must move according to nature, for it is not possible that what is beside nature precede what is according to nature, as is clear from the premises. Now if the first mover moves naturally, necessarily the bodies which follow the motion of the first mover are not being moved by violence nor rest by violence in their appropriate places, but maintain the same order as now prevails, i.e., such that heavy bodies fall to the middle and rest there, but light bodies are borne from the middle and remain above. But this is the situation of the world as it now is; it follows, therefore, that the world would have been before it came into existence. It is not sound, therefore, to posit that the elements, before the world came to be, were being moved according to nature, but according to violence. And thus there follows the same impossibility as for Democritus and Leucippus.

582. The second argument he presents at [†434] and in one sense it leads to the same thing as the first, namely, that the world would exist before it came to be. But the first argument came to this conclusion by considering simple bodies; the present argument concludes to it by considering mixed bodies (for the disposition of both arises in the make-up of the world.

p 3-17

He says therefore: If the elements, before the world was made, were being moved haphazardly, someone can ask whether the elements so moved were able to be mixed in such mixtures that natural bodies such as flesh and bones and so on, would result. If anyone should declare this not possible, it follows that the elements were not in utterly disorderly motion, since, namely, they could not be moved by any and all motions. For Empedocles, in positing that the elements are moved by friendship, said that such bodies were formed by the motion produced by friendship, in such a way, namely, that by the sole motion of the elements by friendship, for one there was generated flesh, for another, bone, for another a head, for another, hands. He further said that as a result of such a combination of elements through friendship, many heads were produced without a neck. If, therefore, it is maintained that it was impossible for these things to be produced, then the elements were not moved wholly without order. But if it were possible for these to be produced, then the disposition of the world was already completed, not only regarding simple bodies, but mixed bodies as well. — It should be noted that the generation of heads without necks is, according to Empedocles, caused by friendship not in terms of a final product of its activity, but as part of the process whereby it gradually reduces the many to one, constituting mixed bodies from the elements.

p 3-17

583. The third argument he sets down at [†435]. It is not directed absolutely against Plato but in combination with the opinions of Democritus and Leucippus, who held that infinite indivisible bodies are being moved in infinite space.

p 3-17

He says, therefore, that if those who posit infinite bodies being moved in infinite space accept Plato's position that before the world the elements were in haphazard motion, an impossibility would follow. For either all those infinite bodies would be being moved by one mover (i.e., according to species, e.g., by heaviness or lightness), or by an infinitude of movers. If by one, then they would have to be moved by one kind of local motion, for example, by upward motion or downward. Consequently they would not be in haphazard motion, since there is already a certain order in the fact that all things are being moved to the same place. But if there were an infinitude of principles, all specifically different, it would follow that the species of motion would also be infinite. But this is impossible, according to things previously set down, in which it was shown that the species of motion are not infinite and indeterminate.

p 3-17

Likewise the same must be said if the principles of the motions are finite and the motions themselves finite — for, if there were finite species of motion, caused by finite principles, there would already be implied in them a certain order. For the disorder of motions does not arise from the fact that not all bodies are being moved to the same place, which is for there to be several species of motion, since even now, when, with the world existing, there is an ordered motion of bodies, not all bodies are being moved to one and the same place, but only those that are of the same genus, as all heavy bodies downward.

p 3-17

He adds therefore by this argument that it is necessary to posit infinite motions if before the world was made bodies were being moved haphazardly.

p 3-17

584. He sets down the fourth argument at [†436], and shows that the position in question contradicts itself. For to exist in disorder is nothing other than to exist beside nature. In sensible things it appears that order is their proper nature, since, namely, through its proper nature each of them is inclined to something definite. But this inclination is the order discerned in sensible things — for things are said to act or to move in a disorderly fashion when this happens contrary to the inclination of a thing's proper nature.

p 3-18

From this it also appears that it is unfitting and impossible for a sensible thing to have a disorderly motion that is "infinite," i.e., enduring for an infinite time, because, as has been said, a disordered motion is one contrary to nature. Now it appears that it belongs to the nature of each thing that it be found in many members of the same genus and most of the time. For what is found in just a few men is not said to be natural to man — for example, to be ambidextrous; nor what is true of some for just a short time — for example, to have a fever. But the natural is that which is found in the greater number and more frequently.

p 3-18

Consequently, the Platonists come to assume two contraries at the same time, namely, that disorderly motion is according to nature, since it existed for an infinite time before the world, and that ordered motion, as well as the world constituted after the ordering of motion, are contrary to nature, since they have existed for a shorter time, even though nothing according to nature is "as it happens," i.e., without a definite order.

p 3-18

It should be noted that the arguments of Aristotle go directly against the position of Plato, if the latter's words mean that there was a disorderly motion of the elements prior to the time that the world was made. But Plato's adherents say that this was not what he understood, but that all order in the motion of sensible things comes from the first principle, so that other things, considered in themselves, outside the influence of the first principle, are disordered. And according to this, Aristotle is not here objecting against Plato's sense, but against the words of the Platonists, lest they lead anyone into error.

p 3-18

585. Then at [†437] he uses the saying of other philosophers to disprove the position in question, because they are seen to have had a better understanding of the matter. Concerning this, it should be noted that Democritus and Leucippus, as well as Plato, seem to have maintained two things in regard to bodies existing before the world: that they are in motion, and that they are segregated.

p 3-18

As to the first, therefore, he says that, with regard to the constitution of the world, Anaxagoras seems to have surmised well. For he posited that the world began from bodies not previously moved. And this is more reasonable than to say that the world was made from bodies previously moved, because motion is a certain act of a thing existing in potency, and, consequently, is intermediate between first potency and first act. But in things that are being brought about, the beginning is taken from what is entirely in potency. Therefore it is more reasonable to fashion the beginning of the world from things wholly not in motion than from things moved.

p 3-18

As to the second he says that even those other philosophers who, in positing the beginning of the world, "gathered together to some extent," (i.e., by saying that before the world came to be, all things were to some extent assembled into one) attempted to explain how things would then be set in motion and separated, in the founding of the world, as did Anaxagoras and also Empedocles. For it is not reasonable to produce the generation of the world out of things previously distant and in motion. For just as motion is a

certain act, so also the distinction, or distance, between things results from their proper forms, according to which things are in act (for insofar as things are in potency they are not distinguished); and since generation strictly comes to be from what is in potency, it is therefore not reasonable to generate the world out of distinct and moved things.

p 3-19

For this reason Empedocles, in explaining the first generation of the world, made no mention of friendship whose function is to assemble the scattered. For Empedocles could not explain the constitution of the "heaven," i.e., of the world, by friendship, in such a way as to constitute it out of things previously separated, by making a gathering together of the previously scattered. For then it would follow that the world was constituted of things previously scattered, which is against the foregoing. Hence, because he used only strife in constituting the world, and strife's role is to scatter the assembled, the consequence is that the world, according to him, came from something one and gathered together out of many things.

p 3-19

Finally, in summary, he concludes [†438] that it is plain from the foregoing that there is for each body a certain natural motion by which it is moved neither by violence nor beside its nature.

Lecture 7 (Aristotle's Text)

 301a23-301b30

[439] We go on to show that there are certain bodies †4 whose necessary impetus is that of weight and lightness. [440] Of necessity, we assert, they must move, and a moved thing which has no natural impetus cannot move either towards or away from the centre. [441] Suppose a body *A* without weight, and a body *B* endowed with weight. Suppose the weightless body to move the distance *CD*, while *B* in the same time moves the distance *CE*, which will be greater since the heavy thing must move further. Let the heavy body then be divided in the proportion *CE: CD* (for there is no reason why a part of *B* should not stand in this relation to the whole). Now if the whole moves the whole distance *CE*, the part must in the same time move the distance *CD*. A weightless body, therefore, and one which has weight will move the same distance, which is impossible. And the same argument would fit the case of lightness. [442] Again, a body which is in motion but has neither weight nor lightness, must be moved by constraint, and must continue its constrained movement infinitely. For there will be a force which moves it, and the smaller and lighter a body is the further will a given force move it. Now let *A,* the weightless body, be moved the distance *CE,* and *B,* which has weight, be moved in the same time the distance *CD*. Dividing the heavy body in the proportion *CE: CD,* we subtract from the heavy body a part which will in the same time move the distance *CE,* since the whole moved *CD:* for the relative speeds of the two bodies will be in inverse ratio to their respective sizes. Thus the weightless body will move the same distance as the heavy in the same time. But this is impossible. Hence, since the motion of the weightless body will cover a greater distance than any that is suggested, †1 it will continue infinitely. [443] It is therefore obvious that every body must have a definite †2 weight or lightness. [444] But since 'nature' means a source of movement within the thing itself, while a force is a source of movement in something other than it or in itself *quâ* other, †1 and since movement is always due either to nature or to constraint, [445] movement which is natural, as downward movement is to a stone, will be merely accelerated by an external force, while an unnatural movement will be due to the force alone. †2[446] In either case the air is as it were instrumental to the force. For air is both light and heavy, and thus *quâ* light produces upward motion, being propelled and set in motion by the force, and *quâ* heavy produces a downward motion. In either case the force transmits the movement to the body by first, as it were, impregnating the air. †3 That is why a body moved by constraint continues to move when that which gave the impulse ceases to accompany it. Otherwise, i.e. if the air were not endowed with this function, constrained movement would be impossible. [447] And the natural movement of a body may be helped on in the same way. [448] This discussion suffices to show †4(1) that all bodies are either light or heavy, and (2) how unnatural movement takes place.

Lecture 7 (Aquinas' Commentary)

Every body moving naturally in a straight line has either gravity or lightness. Natural and violent motions.

p 3-20

586. After showing that natural bodies have natural motions, and disproving the positions of philosophers who erred on this matter, the Philosopher here shows that bodies naturally moved with a straight motion have heaviness and lightness; for the principles of natural motion in such bodies are reckoned with respect to heaviness and lightness.

p 3-20

Therefore, first, he proposes what he intends [†439] and says that it will be plain from what follows that certain bodies, namely, those naturally moved with a straight motion must have heaviness and lightness by which they are inclined to their appropriate places. He says "certain" bodies, in order to distinguish them from those that are circularly moved.

p 3-20

587. Secondly, at [†440] he presents a proof of his proposition, saying: Here we say in a general way that it is necessary for natural bodies to be moved, for they are called "natural" from having within themselves the principle of motion, as is plain from *Physics* II. But if what is moved does not have a natural inclination by which it tends to some determinate place, it cannot be moved either to the center, which comes about through the inclination of heaviness, or from the center, which is due to the inclination of lightness. Therefore it is necessary that bodies which are moved in a straight motion have heaviness and lightness.

p 3-20

588. Thirdly at [†441] he proves what he had presupposed, namely, that if the bodies in question did not have heaviness and lightness, they would not be moved.

p 3-20

First he shows that they would not be moved naturally;

Secondly, that they would not be moved by violence, at 589.

p 3-20

He says therefore first [†441] that if any of the lower bodies does not possess heaviness or lightness, let there be two bodies, and let A be the body lacking heaviness and B the body having heaviness. Now let A, which is the non-heavy body, be moved for a certain period of time, say for the space of one hour, over a magnitude GD, with a motion directed to the center. Then B, which has heaviness, will, during the same time be moved with the same type of motion over a larger magnitude GE; for a body having heaviness must in an equal time traverse a greater distance than a body not having heaviness, just as a heavier body is carried downward more swiftly than a less heavy. Now let B which has heaviness be divided in the ratio of GE to GD so that the whole of B is related to a part, say C, as the whole GE is to GD; for there is nothing to prevent such a division of body B, since every finite body can be divided according to any given ratio. Therefore, let us go on thus. As GE is to GD, so B is to its part C; therefore, by commutative proportion, B is to GE as C (which is part of B) is to GD. If, therefore, the whole B traverses in a given time the entire magnitude GE, then the part of B must traverse the magnitude GD in the same time. But body A (the one having no heaviness) traversed the same magnitude in the same amount of time. Therefore, it will follow that a body having heaviness, and one not having heaviness, will traverse the same magnitude in equal time. And the same argument is valid if the other body is assumed to have lightness. Consequently, it is plain that something irreconcilable follows, if any of the lower bodies is assumed to have neither heaviness nor lightness.

589. Then at [†442] he shows that if any of the lower bodies lacks heaviness or lightness, it cannot be moved by violence. And he says: From the fact that it was shown by the foregoing argument that a body lacking heaviness or lightness cannot be moved naturally with a straight motion, then, if it is moved at all, it must be through violence, for every motion of such bodies is either natural or compulsory. But it cannot be moved by violence either, because, if it were moved by violence, its motion would have to be "infinite," i.e., of infinite speed, which is impossible. And that this would follow he proves by using the principle that if any "power," i.e., violence, moves a body, a lesser and lighter will be moved by the same "power," i.e., by the same violence, "more," i.e., more swiftly, in motion, namely, upward — for a larger and heavier body offers more resistance to violence.

Therefore let A be a body not having heaviness and let it be moved upward violently through the magnitude GE; but let B be a body having heaviness which by the same force in an equal time is moved through the magnitude GD, which is of course less than GE. Just as the heavier is moved less by the same force, so the heavy is moved less than the non-heavy. Let then the body B, having heaviness, be divided in the ratio which is that of the ratio of magnitude GE to GD. It will follow, therefore, just as it did before, that what is taken away through division from body B which has heaviness, will be moved through magnitude GE in a time equal to that in which body A, which lacks heaviness, was moved through it, because the whole body B in the same time was moved through magnitude GE which is less. For the ratio of the speed of the lesser magnitude to the greater must be as the ratio of the greater body to the lesser, so that, in the same time, the greater body is moved a smaller distance, and the lesser body a greater distance, because a lesser body is moved more swiftly by an equal power. It will follow, therefore, that in the same period of time a non-heavy body and one having heaviness are moved an equal distance — which is impossible. But no matter what heavy body is taken and no matter how swiftly it is moved, a non-heavy body will be moved a greater distance in the same time. Accordingly, it will follow that a body lacking heaviness would be moved with an infinite speed through violence — which is impossible. And the same argument holds for a non-light body.

Therefore, in summary, he concludes [†443] that plainly every body which is "determinate," i.e., which is moved with a straight motion has heaviness or lightness. He calls the body which is moved with a straight motion "determinate," either because he is here speaking determinately of it, or because such bodies are moved with a straight motion insofar as they are segregated and divided and not insofar as they are taken all together.

590. Then at [†444], because he had mentioned both natural and violent motion, he now shows how both types are produced. Regarding this he does two things:

First he shows the difference between natural and violent motion;

Secondly, how both are found in air, at 591.

About the first he does two things:

First he shows the difference between natural and violent motion;

Secondly, how violence enters in even to natural motion, at 590.

p 3-21

Now, natural and violent motions differ with respect to their principles, and therefore he first defines the principles of each of these motions [†444]. And he says that nature is a principle of a motion existing in that which is moved, as is plain in *Physics* II: "force," however, i.e., a power that causes motion violently, is a principle existing in another, as it is other. He says this because it could accidentally happen that a principle of violent motion exist in one and the same thing, but not insofar as it is one and the same, but insofar as it is other, as when a doctor heals himself not as doctor but as sick. And from this it is plain that there is a motion that is natural and a motion that is violent. For a motion is according to nature whose principle is in what is moved, not only as active principle, but also as passive, which, indeed, is the potency by which something is naturally capable of undergoing motion from another. Consequently, when lower bodies are moved by the higher bodies, the motion is not violent but natural, because in the lower bodies there is a natural aptitude to follow the motions of the higher bodies. But a motion is violent when no principle of the motion is from within but only from without, as when a man throws a heavy body upward, in which body there is no natural aptitude for such motion.

p 3-22

Then at [†445] he shows as a consequence how violence enters into natural motion. For in the case of a motion which is natural to some body, as for a stone to be moved downward naturally, a force that acts violently sometimes quickens that motion. Consequently, such a motion is in a certain sense mixed, since the kind of motion it is is due to nature, but the addition in speed is due to the violent mover.

p 3-22

But in the case of a violent motion, it is violence that entirely produces it and makes it the type of motion it is, and accounts for the amount of its speed — for to the extent that something from nature should happen to be present in it, to that extent it would not be beside nature.

p 3-22

591. Then at [†446] he explains the role that air plays in both these motions.

First, the part it plays in violent motion;

Secondly, how it serves natural motion, at 592.

p 3-22

He says therefore first [†446] that the force of a violent mover uses the air as an instrument "for both," i.e., for upward and downward motion. For air is apt by nature to be light and heavy: for, as was said above, and as will be explained at greater length in Book IV, fire is absolutely light and earth absolutely heavy, but air and water are intermediate between these two, since air is heavy compared to fire, but light compared to water and earth; but water is light compared to earth, while compared to fire and air it is heavy. Accordingly, air, insofar as it is light, will perfect a violent motion that is upward (but only insofar as it is moved and insofar as the principle of such a motion is the power of the violent mover); and insofar as it is heavy, it will perfect a motion that is downward. For the force of the violent mover, by a kind of impression, imparts a motion "to both," i.e., either to the air moved upwards and moved downwards, or to the air and to the heavy body, such as a stone.

p 3-22

This does not mean that the force of the violent mover impresses upon the stone which is moved by violence some force by which it might be moved, in the way that the power of the generator impresses on the thing generated a form upon which natural motion follows — for then the violent motion would proceed from an intrinsic principle, and that is contrary to the notion of a violent motion. It would also

follow that a stone, by the very fact that it is in local motion through violence, would be altered — and this is contrary to what we sense. Therefore, the violent mover impresses motion alone upon the stone, and this it does while it touches it. But because air is more susceptible to such an impression (both because it is more subtle and because it is in a sense light), it is moved more swiftly through the impression of the violent mover than the stone. Consequently, when the violent mover desists, the air moved by it continues to propel the stone and also the adjoining air, which likewise moves the stone farther, and this continues so long as the impression of the first violent mover endures, as is said in *Physics* VIII. Hence it is that the violent mover, even though it does not follow the mobile that is being carried along through violence, e.g., a stone, so as to move it by being present to it, yet it moves it through the impression of the air — if there were no body such as is the air, there would not be violent motion.

p 3-23

From this it is plain that air is a necessary instrument of violent motion and not simply an improving one.

p 3-23

592. Then at [†447] he shows what role air plays in natural motion. And he says that air promotes the natural motion of each body in the same way as its violent motion, namely, insofar as by its lightness it helps an upward motion, and by its heaviness a downward motion.

p 3-23

593. But the question can be raised whether the air serves the natural motion of heavy bodies and light bodies so as to be necessary or merely helpful.

p 3-23

Averroes says that it also serves natural motion of necessity, and for two reasons. First, because, as he says in his commentary on this passage, the mover of heavy and of light things is their generator which, in giving the form, gives as a consequence the natural motion, just as it gives all the natural accidents which follow the form. Consequently, the generator causes natural motion through the form. Now a natural motion should follow from its mover immediately. Hence, since the natural motion does not follow immediately from the generator but from the form, it seems that the form is the proper mover in natural motion. Accordingly, it seems that heavy and light bodies in a sense move themselves. But not by themselves, because a thing that moves itself is distinguished into mover and moved, as was proved in *Physics* VIII — a distinction not found in heavy and light bodies, which are divided only into form and matter, the latter of which is not apt to be moved, as is proved in *Physics* V. Hence it remains that a heavy or light body moves itself *per accidens,* in the way that a sailor moves a ship through whose movement he himself is moved. Similarly, the light and the heavy body through their form move the air, upon whose motion the heavy and the light body are moved. And thus he concludes that air is necessary for natural motion.

p 3-23

Secondly, because, as he says in his commentary on *Physics* IV, there must be some resistance between mover and mobile. But the matter of a heavy or a light body does not resist its form, which is the principle of motion. Therefore it is necessary that there be some resistance from the medium, which is air or water. Thus air is necessary for natural motion.

p 3-23

594. But both of these arguments proceed from the same source of error. For he believed the form of a heavy and of a light body to be an active principle of motion after the manner of a mover, in such a way that resistance would be required to the form's inclination, and also that motion does not proceed immediately from the generator which gives the form. But this is completely false. For the form of a heavy

and of a light body is not a principle of motion as though it were an agent itself moved, but as that by which the mover causes motion, just as color is a principle of seeing, by which something is seen. That is why Aristotle in *Physics* III, after discussing the motion of the heavy and light, says: "It is plain that neither of these moves itself but that they have a principle of motion, not indeed of moving something or making something, but of being acted upon."

p 3-24

Consequently, the motion of the heavy and the light does not come from the generator through the medium of some moving principle; nor is it necessary to look for any other resistance in this motion than that which prevails between the generator and the thing generated. Consequently it remains that air is not required for natural motion of necessity as it is in violent motion. For what is moved naturally has been endowed with a power which is a principle of motion. Hence it does not need to be moved by something else impelling it, as in the case of a thing violently moved, since the latter has no inherent power, upon which such a motion follows.

p 3-24

The very words of Aristotle point up this difference: For when speaking of violent motion he says, "Unless there were such a body, there would not be motion by constraint"; but in speaking of natural motion he says, "Air helps that motion of each thing which is according to nature."

p 3-24

Finally, in summary, he concludes [†448] that it is plain from the aforesaid that all bodies are either light or heavy, and how unnatural movement takes place.

Lecture 8 (Aristotle's Text)

301b31-302a9

[449] From what has been said earlier †5 it is plain that there cannot be generation either of everything or in an absolute sense of anything. [450] It is impossible that everything should be generated, unless an extra-corporeal †1 void is possible. For, assuming generation, the place which is to be occupied by that which is coming to be, must have been previously occupied by void in which no body was. †2[451] Now it is quite possible for one body to be generated out of another, air for instance out of fire, but in the absence of any pre-existing mass generation is impossible. That which is potentially a certain kind of body may, it is true, become such in actuality. But if the potential body was not already in actuality some other kind of body, the existence of an extra-corporeal void must be admitted.

302a10-302b9

[452] It remains to say what bodies are subject to generation, and why. Since in every case knowledge depends on what is primary, and the elements are the primary constituents of bodies, we must ask which of such bodies †3 are elements, and why; and after that what is their number and character. The answer will be plain if we first explain what kind of substance an element is. [453] An element, we take it, is a body into which other bodies may be analysed, present in them potentially or in actuality (which of these, is still disputable), and not itself divisible into bodies different in form. [454] That, or something like it, is what all men in every case mean by element. [455] Now if what we have described is an element, clearly there must be such bodies. For flesh and wood and all other similar bodies contain potentially fire and earth, since one sees these elements exuded from them; and, on the other hand, neither in potentiality nor in actuality does fire contain flesh or wood, or it would exude them. Similarly, even if there were only one elementary body, it would not contain them. For though it will be either flesh or bone or something else, that does not at once show that it contained these in potentiality: the further question remains, in what manner it becomes them. [456] Now Anaxagoras opposes Empedocles' view of the elements. Empedocles says that fire and earth and the related bodies are elementary bodies of which all things are composed; but this Anaxagoras denies. His elements are the homoeomerous things, †1 viz. flesh, bone, and the like. Earth and fire are mixtures, composed of them and all the other seeds, each consisting of a collection of all the homoeomerous bodies, separately invisible; and that explains why from these two bodies all others are generated. (To him fire and *aither* are the same thing. †2 [457] But since every natural body has its proper movement, and movements are either simple or mixed, mixed in mixed bodies and simple in simple, there must obviously be simple bodies; for there are simple movements. [458] It is plain, then, that there are elements, and why.

Lecture 8 (Aquinas' Commentary)

Lecture 8

Everything not generated. Elements and their existence.

p 3-25

595. After inquiring whether generation and motion are present in natural bodies, and supposing from the previous discussion that they are, the Philosopher here begins to inquire how this is. In regard to this he does two things:

First he takes up again, in order to disprove it, something he had previously disproved incompletely;

Secondly, he pursues his proposition, at 599.

p 3-25

About the first he does three things:

First he states what was proved above;

Secondly, he completes the proof, at 596;

Thirdly, he excludes an objection, at 597.

p 3-25

596. He says therefore first [†449] that it is plain, from what was stated above, that there is neither generation of all things, as those claimed who posited that all things are composed from surfaces, nor no generation at all, as Parmenides and Melissus supposed.

p 3-25

Then at [†450] he completes the refutation of those who posited that there is generation of all things. For he had disproved this previously by showing that bodies are not composed of surfaces. But someone could say that there is generation of all bodies in many other ways. Consequently, the Philosopher presents this more universal proof. And he says that we can get confirmation of the fact that there is not generation of all things from this, namely, because it is impossible for there to be generation of every body, unless a void separated from bodies be posited — which he says because certain philosophers, as Democritus and Leucippus, posited a void inherent in bodies. Now by a separated void is meant a place that is not filled with any body, but which can be filled, as was had in *Physics* IV. The reason why a separated void follows if every body is generated is that, in the place in which a newly generated body exists, if that place existed prior to that body, there would have to be a void there, because no body existed there. But no body would have existed there previously, if every body is generated. Hence the assumption that every body is generated requires the existence of a separated void.

p 3-25

597. Then at [†451] he excludes an objection, for someone could say that we see each body being generated, even though no void exists. But to this he answers that when a certain particular body comes to be, it is generated from some other body, for example, fire from air — and thus, before the generation of the fire, air was in the same place, and so it is not void. But if every body should be generated, we cannot posit another body that previously filled the place, because there is no other body outside of every body. Hence, the body would have to be made from non-body. But it is impossible that a body be made entirely from no pre-existing bodily magnitude. For there would be produced a body in act, above all from that which is body in potency. And if that which is that body in potency is so in such a way as to be actually another body, nothing impossible follows, for that is the way we explain fire as coming to be from matter that is potentially fire, but actually air. But if it were a body in potency in such a way as not to be in act some other body, as those who posit that every body is generated would be forced to assume, it would

follow that, before the generation of every body, there would be a separated void.

p 3-26

598. It should be noted that Aristotle intends to prove here that there is not generation of every body, in the sense of the whole universality of bodies being generated simultaneously. But it is not his intention to prove that some particular body is not generated from non-body. For then there would arise against Aristotle's proof the objection mentioned by Simplicius in his commentary, namely, that a void would not be necessary, either on account of rarefaction and condensation, or because, when this body is generated, another is corrupted. Whence, too, this would not be, as he thought, a sufficient proof that there is not generation of things in common, but of particulars (for there is not generation of man absolutely, but of *this* man), for the whole universality of body is as one complete body existing in one species, as was had previously. But there is nothing to prevent an individual alone in its species from being generated and corrupted, as they say of the Phoenix. Hence there would not be excluded by this the generation of every body, which the Philosopher intends to reject.

p 3-26

Nor is the Philosopher's proof against the doctrine of our faith which teaches that the sum total of bodies at some time began to exist, because we do not posit a pre-existent place, as the Philosopher here supposes; nor do we posit that bodies were generated from what is in potency, but through creation.

p 3-26

599. Then at [†452] he explains how there is generation and motion of bodies. And about this he does two things:

First he states his intention and the order to be followed;

Secondly, he executes his plan, at 600.

p 3-26

He says therefore first [†452] that, since neither is it true that all bodies can be generated, nor that none can, as was said, we are left with the task of showing which bodies are involved in generation, and "because of what this is," i.e., what is the cause of generation. This consideration begins in this book but is completed in the book *On Generation*. But because all knowledge is through certain first things, from which definitions and demonstrations proceed, and it is plain that the elements of any things are first among what is present in the things (although certain extrinsic principles could be prior, e.g., the agent and end), the consequence is that, if we are to understand the generation of bodies, we must first know what are the elements of bodies that can be generated and destroyed, and why they are elements, and how many elements there are, and how many kinds of bodies there are.

p 3-26

Now in order to elucidate all this, it is necessary to take as a supposition and principle what the nature of an element is. And this is revealed by its definition.

p 3-26

600. Then at [†453] he carries out his plan according to the aforesaid order.

First he shows what is the nature of an element, as signified by its definition;

Secondly, what are the elements of bodies and their condition, at 601.

p 3-26

As to the first he does two things:

First he sets down the parts of the definition of element;

Secondly, he proves this definition of element, at 600.

p 3-26

In regard to the first he presents three parts of the definition of element. The first of these is that the element is of other bodies, that into which other bodies are divided or resolved. Not every cause can be called an "element," but only one that enters into the composition of the thing. Hence the universal elements are matter and form, as is plain in *Physics* I. But these are not bodies, whereas the Philosopher is here treating of the elements that are bodies.

p 3-27

The second particle is that an element exists in that of which it is an element, and does so either potentially or actually. (The question of how elements are present in the products of elements, i.e., whether they are present actually or potentially, is for the moment left open). For if the generation and corruption of bodies takes place through assembling and dispersing, as Empedocles and Anaxagoras supposed, then the elements are actually in the compound. But if generation and corruption of bodies are the results of alteration, it is necessary to say that the elements are in potency in the compound.

p 3-27

The third particle is that an element is not divided into other things, namely, things diverse in species. For every body has to be divisible: but some bodies are divided into things that are specifically diverse, as the hand into flesh and bones, out of which it is compacted by a certain composition, or as flesh is resolved into air, fire, water and earth, by a certain alteration. But fire and air, water and earth, are in neither way resolved into things specifically diverse. This particle completes the notion of element; just as letters are called the "elements" of a word, not being divided into things specifically diverse.

p 3-27

Then at [†454] he proves the aforesaid definition by appealing to the way people generally speak — for words are to be used as they are generally accepted, as is said in *Topics* II. And this is what he says, namely, that every one intends to mean by "element" something such as has been described, no matter what the field, for example, in corporal speech, and in demonstrations, in which the principles are called "elements" that are not resolved into other principles.

p 3-27

601. Then at [†455] he shows which things are elements and how many there are. In regard to this he does three things:

First he shows that it is necessary for there to be elements of bodies;

Secondly, he inquires into whether they are finite or infinite (Chap. IV);

Thirdly, whether there is but one element (Chapter V).

p 3-27

Concerning the first he does two things:

First he concludes from the foregoing definition that it is necessary to posit certain elements of bodies;

Secondly, he shows how these were diversely posited by Anaxagoras and Empedocles, at 602.

p 3-27
He says therefore first [†455] that, if the foregoing is the definition of element, it is necessary to say that there are certain elements of bodies, for there exist certain bodies in which the foregoing conditions are verified. For in flesh and wood and all such bodies, i.e., compounds, fire and earth are present in potency, since it is from fire and earth and the like that, by a certain alteration, the above-mentioned bodies are composed. And this is evident by the segregation by which mixed [compound] bodies are resolved into such simple bodies, as is evident when an animal body is resolved, which breaks down into dust and a certain moistness and certain vapors — and similar things happen to other mixed bodies.

p 3-27
That such bodies into which other bodies are resolved are themselves not resolved into others, which also belongs to the definition of element, he shows when he adds that in fire neither flesh nor wood is present, either potentially or actually. A sign of this he takes to be the fact that if flesh and wood existed in fire, fire would be resolved into them, and that never is seen to happen. For flesh or wood are generated from fire, not by resolution, but by the addition of other simple bodies altered at the same time for the composite. But because some philosophers posited but one element, as Thales of Miletus water, he adds that whether one element is posited or many, it is still true that in one element there will not exist other bodies. For although other bodies besides the element may be found, for example, flesh or bone or something of this kind, it must not be said that any of them is present either actually or potentially in the body taken as an element.

p 3-28
Since it is true that there are certain elements of bodies, one must consider what the manner of generation is, by which either other bodies are generated from elements, namely, by compounding, or elements from other bodies, namely, by resolution. And he will settle this as to truth in the book *On Generation*.

p 3-28
602. Then at [†456] he shows how Anaxagoras differed from Empedocles on the question of bodily elements.

p 3-28
First he presents the opinions of each; Secondly, he shows which opinion is to be preferred, at 603.

p 3-28
He says therefore first [†456] that Anaxagoras and Empedocles held contrary opinions on elements. For Empedocles posited that fire and earth, and other intermediates, which are elements with these, are the elemental bodies of bodies, from which all other bodies are composed. But Anaxagoras says the contrary, namely, that other "homoemeric" bodies, i.e., of similar parts, for example, flesh and bone and the like, are the elements of bodies, while air and fire and earth and water he said to be compounded out of the foregoing, i.e., out of flesh and bone and all the other seeds of natural bodies. For Anaxagoras posited that infinite and indivisible parts of similar bodies were the seeds of all things that appear in nature, in the sense that, by their extraction from some compound, all natural sensible bodies are generated. Therefore, because all other bodies seem to be generated from fire and earth and the like, he estimated that fire and earth and other intermediate things resulted from all the indivisible similar parts assembled together. And according to this, he posited the consimilar parts to be the elements of these four bodies, from which he nevertheless said all things come to be on account of the seeds existing therein. And since he did not mention fire, therefore, lest any doubt arise concerning this, he adds that he [Anaxagoras] called fire "aether."

p 3-28

603. Then at [†457] he shows that the opinion of Empedocles is to be preferred. For as is plain from the discussion in Book I, every natural body possesses some proper motion, and since some motions are simple and some mixed, it is clear that mixed motions belong to mixed bodies, and simple motions to simple bodies. And from this it is evident that there are certain simple bodies, since [†458] there are certain simple motions. And since the simple motions, which are from the middle and to the middle, belong more to the elements posited by Empedocles, it is plain that his opinion should be preferred.

p 3-28

However, this could be called a second argument in support of the principal conclusion which he draws as a summary, saying that it is plain that elements exist and for what purpose they exist.

Here ends the Exposition of St. Thomas.

Footnotes

†1 i.e. animate things, such as plants and animals.

†2 e.g. matter and form, movement, or, in the case of living things, soul.

†3 Viz. beginning, middle, and end.

†4 Oaths, for instance, usually appeal to three Gods, as in the Homeric appeal to Zeus, Athene, and Apollo (Prantl).

†5 Reading {eilephamen} with E and Prantl. The other MSS. have {phamen} (FLM) or {kataphamen} (HJ).

†6 Reading {eiper ara} with FHMJ.

†1 Body alone is so determined, and only what is so determined is a totality (an 'all'). Put a comma, instead of a full stop, after {trisin}. The words {touto d' esti pan} are difficult to interpret. Prantl makes {touto} predicate, and translates as though we had {to pan} instead of {pan}. Simplicius gives no help.

†2 To be incomplete or defective is to lack being in some respect.

†3 i.e. the elements.

†4 The 'parts' or elements are bodies, and therefore complete in the sense just given to the word. They are, however, only parts, and as such limited in their being by the juxtaposition of other parts. This suggests a development of the notion of completeness which will make the term 'complete' applicable only to the unrestricted being of the whole.

†1 See c. vii.

†2 i.e. the elements, which represent the ultimate distinctions of kind among bodies.

†3 Cf. *Phys*. 192b20.

†4 Reading {ekolouthekenai kata logon} with all MSS. except E.

†5 {Ta touton eide} ('with their kinds') can hardly mean *kinds of* fire and earth (e.g. sandy and stony earth, flame and glowing coal), as Simplicius supposes, for there is no variety of movement corresponding to this variety of kind. Rather, as Alexander supposes, the phrase is a generalizing formula ({anti tou katholou pan pyr} . . . {kai katholou pasan gen}): fire and its kind, earth and its kind, and other species of the same genus (viz. air and water, and the 'fifth body' of which the stars are made).

†1 Reading {heautou} with all MSS. except E.

†2 Therefore neither of these can be *also* the contrary of circular motion. Thus there is *no* simple motion opposed as contrary to the circular.

†3 Reading {pason gar esti ti ektos} ({esti} is omitted by E alone).

†1 From his premises Aristotle is here entitled to conclude not merely that circular movement is the movement of a simple body, but also that it is the movement of a simple body prior to the other simple bodies. Prantl therefore inserts {proterou} after {tinos} and appeals to Simplicius's paraphrase for corroboration. Simplicius, however, not only does not corroborate the conjecture but actually points out that this part of the conclusion is suppressed ({hoper hos saphes pareke}). The insertion of {proterou} does not really make the argument any clearer.

†2 Cf. Plato, *Phaedo,* 111B.

†1 Reading {hikanos hos pros} ({hos} is omitted by E alone).

†2 Below, Bk. IV, cc. i-iv.

†3 Reading {ananke de} ({de} is in F alone).

†1 *Phys*. I. vii-ix. For the phrase, cf. 311a12.

†2 Omitting {kai to phthinon phthinei} (l. 23). These words are omitted by three representative MSS. (EFJ), are not referred to by Simplicius or Themistius, and are an awkward intrusion in the sentence since what follows applies only to increase. For the doctrine, cf. *De Gen. et Corr*. I. v.

†3 Increase is effected by generation of one kindred body out of another. This body has no contrary out of which it can be generated. Therefore it cannot increase.

†4 Reading {aphthiton} with H (so Prantl). All other MSS. have {aphtharton}; but the rare {aphthiton} would be easily altered to the commoner word. Simplicius has {aphtharton}, but explains that {phthisis} is a kind of {phthora} and so {aphtharton} may be used for {aphthiton}.

†1 Simplicius says he 'has been told' that there are written astronomical records ({astroas tereseis anagraptous}) in Egypt for the past 630,000 years and in Babylon for the past 1,440,000 years.

†2 i.e. {aither} from {aei thein}. The derivation was suggested by Plato (*Cratylus,* 410 B).

†3 i.e. deriving {aither} from {aithein}. Cf. Bk. III, 302b4.

†1 The point of this elliptical argument seems to be that, while the generally admitted case of contrary opposition (viz. that of upward and downward motion) rests on a contrary opposition of places (viz. above and below), no such ground can be suggested for the opposition of circular to rectilinear motion.

†2 FIG. I.

†3 FIG. II.

†1 FIG. III.

†2 *Phys*. V. v, 229b21.

†3 Reading {hoti} for the {eti} of our MSS. after Simplicius, who had both readings before him.

†4 Prantl's alteration of {gar} into {ar'} is not needed. The {gar} refers back to the remark 'one of the two would be ineffective'. That remark is therefore repeated in the text.

†5 The bearing of this argument is clear if it is remembered that the assertion of the existence of a certain movement necessarily involves for Aristotle the assertion of the existence of a body which naturally exhibits the movement. Similarly the assertion that a movement is inoperative involves the assertion that a body is inoperative.

†1 Reading {ten peri tes} with FHMJ. The phrase recurs in this form in *Met*. 993a30.

†2 After Plato, *Cratylus,* 436D.

†3 The {estai} of all other MSS. is preferable to E's {einai}.

†1 'The centre', when not in any way qualified, means the centre of the earth, which is taken by Aristotle to be also the centre of all the revolutions of the heavenly bodies. He cannot here mean the centre of the supposed infinite body, since to that no shape has yet been given.

†2 The last phrase ({ou meden estin exo labein}) seems to have been misunderstood by Prantl. a comparison of this passage with others in which what is practically the same phrase occurs (esp. *Met*. 1021b12, 1055a12) shows *(a)* that {ou} is governed by {exo} ('outside which'), and *(b)* that the phrase is roughly equivalent to {teleion}. The point here is that by {diastema} he means, not a straight line spanning the interval between the radii, but the whole area enclosed between the two radii and the portion of the circumference which connects their extremities. In l. 30 read, after {diastema}, {de} rather than {gar}, which is in E alone.

†3 Reading {eti} with the MSS.; Prantl's {epei} seems to have nothing to recommend it. It will then be necessary to put a full-stop after {diastematos} in l. 3. This sentence gives, of course, a second reason for taking the {diastema} to be infinite.

†4 FIG. IV.

†1 In this argument the ascertained fact that the revolution of the heavens occupies a limited time is used to prove the finitude of its path and consequently also of the body itself. *BB* represents an infinite line drawn within the infinite body and therefore 'traversed' by that body in its revolution. But there can be no point at which the contact of *ACE* with *BB* either begins or ends, while there is a time within which the revolution is completed. Therefore the revolving body is not infinite.—Possibly the centre of the movement of *ACE* should be *a* (as in F and Simpl.) rather than *C*.

†2 Movement of the 'world' ({kosmos}) is here used for movement of the 'heaven' ({ouranos}). Either

†2 Movement of the 'world' ({kosmos}) is here used for movement of the 'heaven' ({ouranos}). Either {kosmos} stands for the heavenly body, as in *Nic. Eth.* 1141b1, or the movement and the infinity are treated for the moment as attributes of the whole.

†3 Aristotle refers to the *Physics,* here and elsewhere, as continuous with the *De Caelo.* Different parts of the *Physics* are referred to by different names. Simplicius (p. 226, 19) observes that *Phys.* I-IV are cited as 'the discussion of principles' ({peri archon}) and *Phys.* V-VIII as 'the discussion of movement' ({peri kineseos}). In *Phys.* VIII, 257a34, Aristotle refers back to an earlier passage as occurring {en tois katholou tois peri physeos}; and Simplicius, commenting on this *(Comm. in Phys.* p. 1233, 30), 'infers' that *Phys.* I-V are the {peri physeos} and *Phys.* VI-VIII the {peri kineseos}. But his inference is false. The reference is not, as he thought, to V. iv. The principle had been asserted earlier, viz. in III. i. The 'general considerations concerning nature' may therefore be identified with the 'discussion of principles', and the *Physics* may be divided in the middle, i.e. at the end of Book IV.—The reference in this passage is to *Phys.* VI vii.

†1 Reading {kakeine parallattei ekeinen} with FHMJ. The alternative to {parallattei, par',} rests upon the sole authority of E: for L has {parallatte}. {Par'} is intolerable, since it must stand for {pheretai para} and thus attributes movement to *B,* of which in the same sentence it is said that it may be unmoved.

†2 The reading is doubtful. It is difficult to attach any other sense to the possession of {peras} ('limit') than a denial of infinity; in which case {all' eiper, epi mekos} means 'or if a finite line is infinite, it is so in length'. The antecedent thus appears to contradict both itself and the consequent. Simplicius preserves a variant for {epi mekos, epi thatera}. ('A finite line can only be infinite, if at all, in one direction'.)—Perhaps, however, the text is correct. The sentence may be paraphrased as follows. a limited line cannot be infinite: lines, in fact, can only be infinite, if at all, in that respect in which they are unlimited: but there is nothing in the nature of 'line' to determine the length of any given line: consequently, it is only in respect to length that infinity is ever ascribed to lines. (Mr. Ross suggests that {he} should be read instead of {hes} in l. 17. 'A line cannot be infinite in that respect in which it is a limit.' The line is the limit of the plane, i.e. a limit in respect of breadth. Similarly the plane is the limit in respect of depth. This correction has support from the translation of Argyropylus ('ex ea parte qua finis est'), and is probably right.)

†1 Also, of course, infinite.

†2 FIG. V.

†3 The 'infinite line' is the infinite radius *CD,* which is unable to complete the circle owing to its inability to extricate its outer extremity from that of the other infinite, *E.* The MSS. vary between {kykloi} (EL), {kyklo} (M), and {kyklon} (HFJ: the last, however, has {oi} *suprascriptum*). In FMJ {perieisi} follows instead of preceding {kyklon} ({kyklo} M). Perhaps {kyklon perieisin} should be read with FJ, though either reading will give the sense required.

†1 The preceding six arguments start from the hypothesis of an infinite body and show the difficulties involved in the consequent assumption of an infinite path and in the infinite time needed for its completion. The converse argument starts from known finite time of revolution and argues from that to the finitude of the path traversed and of the body which traverses it.

†2 Reading {eie he kinesis}, with FHMJ Simpl.

†3 *Phys.* VIII. viii.

†1 FIG. VI.

†1 Delete comma after {BD}.

†2 There can be no doubt that the comma should follow, not precede, {kai eti} (l. 5). The phrase {tosonde hoson to peperasmenon kai eti} is parallel to the {tosouton kai eti} of 273b31. Bonitz (*Ind*. 291a7) takes {kai eti} in this way, but appears to interpret the phrase as indicating the distance moved, which is impossible.—For the use of {kai eti} cf. *Met*. 1021a6.

†3 Because, as explained in the following sentences, there is no time for it to move in. The argument is: the infinite may ({men}) be regarded loosely as something exceedingly great, in which case it follows simply that it moves exceedingly fast: so far there is no difficulty: but ({de}) as soon as you begin to specify *how* great it is and *how* fast it moves the difficulties become insuperable.

†4 {all' aei en elattoni} is probably an opponent's objection. It is an application of the argument mentioned in 272a1. We talk of number as infinite, A. says there, because there is no maximum. Similarly the advocate of infinite weight says, 'At any rate the weight can be increased and the time proportionately diminished *ad infinitum*'. But the motion of the infinite, to be conceivable, must according to Aristotle occupy *a time;* and any time, however small, will be a time in which the given movement could be effected by a finite body.

†1 What difficulty there is in this sentence is due to the elliptical expression and to the tacit inference from a proportion between the times to a proportion between the bodies. What is known is the ratio between the imaginary minimum time assigned to the infinite body and some other finite time. A. speaks of this known ratio as a ratio between the infinite body and another body. The argument is: take any other finite body ({heteron}): its ratio to the infinite may be determined by their respective times: but another finite body ({allo ti peperasmenon}) could be found in the same ratio (on the basis of a comparison of times) to the first. Thus a finite body will cover the same distance as the infinite body in the same time, which is absurd. —The comma after {logo} in l. 11 should be deleted. {meizon} belongs to the predicate both of the relative clause and of the main sentence. Neither Simplicius nor Alexander (as reported by Simplicius) seems to have interpreted the words quite correctly.

†2 *Phys*. III. iv-viii (see n. on 272a30). Read {eiremenous} with FM.

†1 Reading {eige} with FHMJ.

†2 'As Anaxagoras seems to have supposed' (Simpl.).

†1 Because an infinite place cannot exclude, or be 'other' than, any finite place. This argument applies to natural as well as unnatural movement: for a body moves naturally in the effort to reach its place.—Read {topos allos isos} with EL, confirmed by Simplicius ({topos isos allos}, 239, 24).

†2 Read {kinethesetai} with Simplicius and all MSS. except E.

†1 Called *BF* a few lines below.

†1 These sentences are rather disjointed and read more like rough notes than a finished argument. The final remark seems inconsequent. We should expect: 'but what is not perceptible cannot occupy a place'; so that the hypothesis that the body beyond the heaven is {noeton} contradicts itself. The main point, however, is that all these connected attributes are inapplicable to an object of intelligence like the Platonic {eidos}.

†2 *Phys*. VIII. x.

†3 The last argument (from 'Again, what is it . . .') is not a mere repetition of the preceding. The preceding sentence shows that an infinite disturbing force is needed to account for any unnatural movement of an infinite body. Finally, it is suggested that even the natural or normal movement of such a body would presuppose an independent infinite force. Again, the foregoing argument applied only to rectilinear

movement, since unnatural circular movement has been shown to be impossible: but the last argument would apply equally to circular movement. The remark 'if it moves itself, it must be animate' implies that it is incorrect to think of the natural movement of the elements as self-movement. It is only movement uninfluenced by any sublunary body. That self-movement is impossible Aristotle has already shown in *Phys*. VII.

†1 Prantl misprints {ei} for {ei}.

†2 In l. 18 Prantl's {legomen} seems to be a misprint for {legomen}.—'Heaven' here stands of course for world ({ouranos = kosmos})—The reference is to c. vi (274a24).

†1 Reading {mia d' he} with EF 2M Alex. The {gar} of the other MSS. and Simpl. is misleading and suggests an argument where there is none. The principle is simply stated for future use.

†2 Above, cc. ii-iv.

†1 In l. 17 the comma which Prantl places after {physin} should be placed instead after {meson}. It is needed in this place in order to show that the following clause {dia to . . . allegous}) is explanatory of the {ananke} of l. 14, not of {pheresthai} in l. 16.

†2 If there is one centre and one extremity, there is only one heaven or world. (Read {toutou d' ontos, adynaton ktl}. Prantl's {atopou} is found only in F and J, and in both it is preceded by {tou}, which shows that it is an adscript intended to explain the meaning of {toutou}.)—The argument of the chapter down to this point is a single *reductio ad absurdum*. Simplicius tries unsuccessfully to interpret it as a series of reductions. The remainder of the chapter reasserts the conclusion here drawn by closing up various pathways of escape. In truth there is only one way of escape, as Aristotle here says, viz. to deny the identity of the fire and earth in the other worlds with that in our own; but the contention takes a variety of forms—(1) 'distance makes a difference'; (2) 'they have no movement, or only move by constraint'; (3) 'the goal of their movement is only the same *in kind* as that of the corresponding elements here'. These suggestions are refuted in what follows.

†3 Throughout this paragraph when Aristotle speaks of 'the bodies' he is thinking of the fire, earth, &c., supposed to constitute another {kosmos}. He is not proving over again the proposition that the four elements have each a natural motion, but considering what would be their motion in another world existing beside our own. The empirical evidence of movement here appealed to must be that of the fire and earth of this world; but a thing that did not move would not be a body at all.

†1 Read {to men to d' ou} with FLJ Simpl. The meaning is that since none but a 'numerical' difference can be postulated between the portions (e.g. of earth) in this world and those in another, and since a difference of goal can only be justified by a difference in the body, we should have to suppose a distinct goal for every single portion of earth; which is absurd.

†2 a full-stop, rather than a comma, is needed after {metabole} in l. 16. Three principles are laid down and all are illustrated in the case of locomotion. But the instances of health and increase are used only to illustrate the first.

†1 ll. 18-19, the full-stop after {poi} should be deleted, and the words {dei ara} . . . {pheresthai} should be marked as a parenthesis. Locomotion, like healing, has a determinate direction, and that involves a difference of form between its two terms.

†2 The remarks which follow concerning circular motion are a kind of footnote and would be best marked as a parenthesis.

†3 In l. 29 it is tempting to read {ei d' eis apeiron en} for {ei d' apeiron en}, but no evidence of such a reading survives. The sense of the paragraph is plain. We observe an increase of speed in a falling body as it approaches the earth. The explanation, on our view, is the proximity of the goal. But if there is no goal, the movement, and with it the increase of speed, is capable of continuing to infinity. But infinite speed means infinite weight, which has already (c. vi) been proved impossible. The Greek of the last sentence is puzzling and may be corrupt. Accepting the text of Bekker and Prantl, we must translate as follows: 'as that which by reason of speed is lower than another body would be presumed speedy by reason of weight, so if there were infinite increase of weight there would also be infinite increase of speed.' (The alteration of an accent is required: {barei} for {barei} in l. 32.) The sentence is clumsy, but it gives the required sense. Simplicius seems to have interpreted the passage as above. In l. 31 {heterou} is found in F alone, all the other MSS. giving {heteron}; but {heterou} must be right.

†4 The atomists, Leucippus and Democritus.

†1 i.e. Metaphysics. Cf. *Met*. {L}. 8.

†2 Prantl misprints {eis} for {eis}. For {ouranos} read ({ho ouranos} with M. J, like EHL, omits the word {ouranos} altogether.

†1 More correctly: that the heaven should be *necessarily* one and unique. The argument here set out only attempts to prove the possibility of more than one world, and Aristotle replies by proving the impossibility of more than one. Alexander (cited by Simpl.) points out this defect in the statement.

†1 The {oi} before {ouranoi} is attributed only to E, and to it 'dubio'. J has it. But the article does not seem to be required here. In corresponding passages in this chapter it is omitted.

†2 Read {tinos hyles}. The omission of {tinos} in E must be a mere slip. All the other MSS., as well as Simpl., have {tinos hyles} and E is full of small omissions.

†1 Place a full-stop after {phamen}. In the next line {syneches} should be {syneches}.

†2 Read {to men gar}. The {men} is wanted, and is omitted by E alone. The reference is to cc. ii and iii above.

†3 c. ii above.

†1 i.e. {aion} is derived from {aei on}.

†2 Aristotle refers apparently under this name to elementary handbooks of philosophy current among his audience. It is usual to identify them with the {exoterikoi logoi}, as Simpl. does in his commentary on this passage. See Bonitz, *Ind. Ar.,* s.v. {'Aristoteles}, 105a27.

†1 Prantl misprints {tyn enantion} for {ton enantion} in l. 6.

†2 The former view, according to Alexander (*ap*. Simpl.), is that of Orpheus (i.e. of Orphic cosmogony), Hesiod, and Plato, while the latter is that of Democritus and his school.

†3 Cf. Burnet, E.G.P.@3 p. 157 (§ 77). Heraclitus and Empedocles are agreed in believing in periodic changes in the constitution of our world as a whole. For both, the world exists, as it were, in a succession of lives (below, 280a14); and the view is a kind of compromise between that which regards it as eternal and that which gives it a single life ended by annihilation. The phrase 'alternation in the destructive process' is somewhat inaccurate, since the alternation may be described as between generation and destruction (Empedocles' Love and Strife, Stoic {diakosmesis} and {ekpyrosis}). But it is intelligible. Aristotle is here

classing the theory for convenience with those that hold to a destructible world, and the antithesis is between destruction {aplos} and destruction with alternation. Later he explains that this alternation is not {phthora} at all. Burnet in his first edition proposed to excise {phtheiromenon}, but the suggestion is now tacitly retracted. In his later editions Burnet wrongly states that what is here in question is the eternity of the first heaven. That has already been proved in c. iii, and the first heaven would not be referred to as {ho kosmos}.

†1 a comma is required after {aiona} in l. 22, unless the comma after {echein} in the preceding line is deleted.

†2 The close coordination of {ei men} (in l. 25) with {ei de} (in l. 26) demands a comma, rather than a full-stop, after {egeneto}.

†3 Simpl. refers the following argument to Xenocrates and the Platonists.

†1 i.e. the geometricians can truly write Q.E.F. at the end of their construction, but these cosmogonists cannot. The figure, or world, constructed should be 'the same' {to auto} as that demanded in the {hypothesis}.

†2 Cp. Plato, *Timaeus* 30A.

†3 The construction of the cosmogonist cannot be a mere didactic device like that of the geometrician; for the attributes successively assumed in the construction of the world cannot exist simultaneously as those assumed by the geometrician do.

†4 Here Aristotle clearly refers to Empedocles, rather than to Heraclitus. The two causes of Empedocles are Love and Strife ({philia} and {neikos}), and since these are two it follows, Aristotle argues, that the world would merely oscillate between two arrangements or dispositions.

†1 In l. 29 Prantl misprints {kmi} for {kai}.

†2 a colon instead of a full-stop is needed after {Timaio}. The reference is to Plato, *Timaeus* 31. Plato is quoted as authority for the indestructible-generated not for the ungenerated-destructible, as the context shows.

†3 The general question is the mutual relations of the terms 'generated', 'ungenerated', 'destructible', 'indestructible', which have so far been considered only in their application to the heaven. The terms are discussed universally, i.e. apart from any special application, in cc. xi and xii. The combination attributed to Plato is refuted at the end of that discussion (283a1 ff.). Simplicius found the argument of the last paragraph of this chapter (ll. 23ff.) somewhat obscure. It deals, provisionally and subject to further investigation, with the view that the world is subject both to generation and to destruction in the sense in which the man Socrates is. Simpl. is probably right in supposing that under this head Aristotle is thinking of the atomists. Their infinite worlds were successive, if also co-existent. Aristotle here argues that if that out of which the world was formed had the capacity to give birth to a world, then that into which the world is destroyed will have the same capacity. Thus the theory of world-annihilation is dismissed as absurd, while the infinite succession of destructible worlds is left open. But the refutation even of the first of these views, and therefore *a fortiori* of the second, cannot be regarded as complete until the whole problem of generation and destruction has been examined.

†4 It is unfortunate that 'generated' and 'destructible' are not similar grammatical forms as the Greek {genetos} and {phthartos} are. But from the analysis given by Aristotle it will be seen that in meaning the Greek verbal adjective tends to approximate to the past participle, and therefore it is not worth while to insist on 'generable', 'ungenerable' for {genetos, agenetos}.

†1 For {ean he genesis} read {ean e genesis}. (M has {e he}, but all other MSS. have {he}.) The correction was suggested by Hayduck (Greifswald Gymnasium Program, 1871, p. 11).

†2 The evidence afforded by Simpl. and the MSS., together with the difficulty of establishing a precise correspondence between this definition of {phtharton} and the parallel uses of 'ungenerated' *(b)* and 'generated' *(a)*, might lead one to doubt the soundness of the text at this point; but it is guaranteed by Aristotle's own citation at 281b27.

†1 Aristotle carelessly omits to mention the other and more exact kind of possibility. Cf. 'ungenerated' *(c)* and 'generated' *(b)*.

†2 The third {e} (in l. 29) is not coordinate with the two which precede it (ll. 26, 28), and it would be well to mark this by putting a colon instead of a comma after {eisin} in l. 28. Simplicius read {e kai ouk} in l. 29, and the addition of {kai} would be an improvement.

†3 Omit the {ouk} inserted by Prantl before {endechomenon}. The {on de} which Prantl's note attributes to Simplicius is found only in one inferior MS. and is not printed in Heiberg's text of the commentary. J also has no word between {ephtharmenon} and {endechomenon}, nor had Alexander.

†4 Read {legetai gar} for {legetai de} and place a colon instead of a full-stop before {legetai}. This alteration is conjectural, but it is preferable to Hayduck's excision of {e kai} . . . {einai} (ll. 33, 34), and without some alteration the Greek will not give a satisfactory sense. The account given of 'indestructible' is closely parallel to that given of 'ungenerated' above. Sense *(a)* of 'indestructible' (ll. 26-28) turns on the absence of process, like sense *(a)* of 'ungenerated', even repeating the same instance, touch. In sense *(b)* (ll. 28-31) 'indestructible' covers all that has not been destroyed, as 'ungenerated' in sense *(b)* covers what has not yet come into being: as 'ungenerated' includes all possible existents which are now non-existent, so 'indestructible' includes all possible non-existents which are now existent. There remains the third and proper sense, viz. potentiality or possibility, subdivided in the case of 'ungenerated', according to an ambiguity in the word possible, into (i) strict and final impossibility ({to me alethes einai eipein}), (ii) popular or 'practical' impossibility ({to me rhadios mede tachy e kalos}). The third sense of 'indestructible' is introduced by {to de malista kyrios} in l. 31, and its subdivision is effected by {e kai} in l. 33. The words before {e kai} assert the final removal of the possibility of non-existence, and the following clause relaxes the requirement as popular use demands. Even if the possibility of destruction has not been finally removed, a thing may be called 'indestructible' in this sense if it has not been destroyed. '*For* ({legetai gar}) what is not easily destroyed is called indestructible.' By calling this the proper sense, whether in its stricter or more popular use, Aristotle must mean that the verbal adjective in {-tos} should not in precise speech be allowed to approximate, as it often does, to a past participle passive. (Simplicius's interpretation of this passage is quite inadmissible, but he was confused by faulty MSS.)

†1 'Power' ({dynamis}) must be taken throughout as the noun corresponding to the adjective 'possible' ({dynaton}).

†2 The MSS. have {kinethenai stadia hekaton} ('to move a hundred stades'). The translation omits the reference to distance, which seems clearly out of place. The words {stadia hekaton} which occur more than once in the context, probably got their place in this clause through a copyist's mistake.

†3 Prantl misprints {hyperbalen} for {hyperbolen}.

†1 i.e. sometimes the maximum is an actual maximum (determined 'in the object', {epi tou pragmatos}), e.g. in the case of weight-lifting, where the largest weight lifted serves to define the power; sometimes it is an actual minimum, determined as maximum 'in the power' ({epi tes dynameos}), e.g. in the case of vision, where the smallest object seen serves to define the capacity. Cf. the distinction between the {meson tou

pragmatos} (or {kata to pragma}) and the {meson pros hemas} in *Eth. Nic.* 1106a26 ff.

†1 Cf. *Anal. Prior.* 34a1 ff. for this distinction. There should be a colon rather than a full-stop after {adynaton}. The production of like consequences is of course not peculiar to the impossible hypothesis: it applies equally to the false hypothesis. See *loc. cit.*

†2 Read {ei de} with FHMJ for {ei de}. There is no semblance of inference. Simplicius makes the connexion antithetical.

†3 For {estai} read {esto} with all MSS. (except E) and Simpl. The {me einai} which follows {dynatai} in FHMJ must have been a copyist's mistake.

†4 The assumption in this case was both false and impossible.

†5 The words are taken in their 'most proper' sense, as the qualification 'absolutely' in l. 25 suggests; viz. as conveying a strict and demonstrable possibility or impossibility. See foregoing chapter.

†1 In l. 29 after {me einai} a full-stop is required instead of a comma. The construction of the following clauses is difficult. The translation given above proceeds on the hypothesis that no stop is required after {aei on} (l. 30) and that {dynaton} . . . {hoste me einai} is equivalent to {dynaton me einai}. I cannot find another case of {dynaton hoste} but similar uses of {hoste} are fairly common in Aristotle (see Bonitz, *Ind. Ar.,* p. 873a20). {out apeiron oute peperasmenon} (sc. {chronon}) is a loose epexegesis of {ouk estin en ho chrono}, and perhaps should be preceded by a comma.

†2 {Kai aei me einai} is the reading of FJ Simpl. Since the omission of {aei} in the other MSS. is easily accounted for, it seems best to accept this. (J at the first attempt omitted the {kai}.)

†3 After {pote on} a comma, not a colon.

†1 The four letters *ABCD* are to be allotted as follows: *a* is 'that which is always capable of being' = 'what always is', *B* is its contrary, *C* that which is always capable of not being' = 'what always is not', *C* is its contradictory, 'that which is not always capable of being ', and *D* is the contradictory of *B,* 'that which is not always capable of not being'. *C* and *D* might also be described by the terms 'what not always is' and 'what not always is not' respectively.

†2 281b18 ff.

†3 The question-mark should come at the end of the line after {on de}, preceded by a comma at {einai}.

†4 i.e. each term has its third sense as defined in chapter xi (280b11, 31).

†5 The term 'coincidence' is used in this passage to express the mutual involution (called by later writers {antakolouthia}) of predicates. This mutual involution is here described by Aristotle in terms which mean that the two terms 'follow' or 'accompany' one another. But later on (e.g. in 282b10, 27, 32) he frequently says simply that one predicate 'follows' another when he means that the two terms are mutually involved. To avoid confusion I have expressed the relation in terms of coincidence throughout.—The {e} following the parenthesis introduces an alternative proof to the same effect as that which preceded the parenthesis.

†1 281b25 ff. But Aristotle proceeds to give a proof of the mutual involution of these terms. If the destructible is generated and the generated is destructible, it follows that the ungenerated is eternal and the indestructible is eternal, and this is the thesis set out for proof in 282a25. But the proof here given of the antecedent depends on the assumption that 'ungenerated' and 'indestructible' are coincident, which assumption is now proved. Aristotle's procedure, however, is needlessly complicated. Having proved the coincidence of 'generated' and 'destructible' by assuming the coincidence of 'ungenerated' and

'indestructible', he now proves the coincidence of the latter by proving (on other lines) the coincidence of the former.

†2 i.e., in effect, 'neither in the past nor in the future'. But time, of course, has no limit. The notion of limit is transferred to the indestructible-ungenerated from the destructible-generated. The being of the latter class is necessarily limited in both directions, by birth on one side and death on the other, and the same terms limit its not being. These two limits of finite existence are used to describe the two directions of infinite existence.

†1 Aristotle now proceeds to apply his results to the refutation of the view attributed in 280a30 to Plato's *Timaeus*. He there promised to give a clearer demonstration of its absurdity when the terms 'generated', 'ungenerated', &c. should be investigated on their own account and apart from the special case of the heaven.

†1 The words {hama gar} . . . {kai einai} are plainly parenthetical, since the {to men, to de}, which follow explain the clause which precedes them. They should be enclosed in brackets and the colon after {chronon} deleted.

†2 Read {ha dynatai}. Prantl's note is incorrect. The facts are as follows: {ha dynatai} FM Simpl., {ha dynantai} EL, {adynata} HJ. Bekker prints the last, though attested by only one of his MSS.

†3 The third argument is distinct from the second in that the second arrives at an *absurdum* by actualizing the capacity, while the third points out that the co-presence of two such capacities has already been admitted to be impossible. Cf. 282a5, 'that which is always capable of being' is the contrary of 'that which is always capable of not being'. Alexander seems to have maintained that our third argument was not a distinct argument at all; but the short account of his view given by Simpl. is not convincing.

†4 a colon is required after {hysteron}. Aristotle is proving that the capacity was present for infinite time, which in argument (3) he assumed as evident without proof.

†5 Prantl's note as to the reading in l. 26 is inaccurate. The words {kai aphtharton} (not {kai phtharton}) were lacking in the MSS. used both by Alexander and by Simpl.; and they interpreted the sentence without those words to mean—'it will be at once eternal and in actuality destructible'; but 'in actuality destructible' means 'destroyed', and therefore the assertion is not justified by the context. Alex., however, suggested the insertion of the words {kai aphtharton}, and Simpl. says he 'has come across' a manuscript in which the words are found. {kai aphtharton} seems to have been added to E upon revision, but all our other MSS. have the words, and it is best to retain them in the text.

†1 The end of this paragraph from {kai ei geneton} seems to be a short statement of the parallel argument with regard to generation. If this is so we require a full-stop instead of a comma after {phtharton}. {to phtharton} can hardly be the subject of {gegonen}, as Prantl's stopping suggests. The last words, {kai me aei ara einai}, are unsatisfactory, since, though they draw a true consequence, it is one more directly appropriate to {phthora} than to {genesis}. It is tempting to read {kai me aei ara me einai}. We should then have the relevant consequence and a more precise parallelism between the two arguments.—The point of the paragraph as a whole is to remove the possibility of an escape, by means of a doctrine of unrealized possibilities, from the conclusion already drawn that what is generated is also destructible. (Simpl. appositely quotes *Timaeus* 41 A, B, where the permanence of the world-order depends on the will and promise of the Demiurge.) Aristotle always maintains that an unrealized possibility in this sense is inconceivable.

†2 For Prantl's {kai hama} read {hama}. The {kai} is omitted by FMJ Simpl.—The notions of 'chance' ({to automaton}) and 'fortune' ({tyche}) are fully discussed in *Phys*. II. iv-vi, the exclusion of the

'necessary' and the 'usual' (285a32) being explained in II. v. It is there plainly implied that chance had actually been suggested by earlier writers as the generative cause of the world (196a33, 198a10). The reason why they had recourse to this notion would be that chance means a cause quite external to the nature of the thing considered; and thus the chance generation or destruction of the world would not involve the consequence that in general and as such the world was either generated or destructible. Aristotle's reply to the suggestion is simply that chance necessarily implies intermittent being, so that a chance-eternal is a contradiction in terms. ('Fortune' is a name for chance within the sphere of conduct; and anything which can be caused by chance could also, according to Aristotle, be caused either by intelligence, as in the case of conduct, or by nature, as here. See *Phys.* l. c.)

†1 For {esti, estin} read {esti, estin}.—The concluding argument is introduced very abruptly, by a formula which shows that in Aristotle's mind the suggestion here criticized is only another form of the appeal to chance just dealt with. The suggestion is that a capacity may be limited in respect of time of fulfilment. Aristotle refutes it by assuming that its authors admit *(a)* that the *possession* of the capacity is not limited in time, and *(b)* that any capacity may be actualized.

†2 Before {plen} a comma is required instead of Prantl's full-stop.

†3 {ou} must be taken to stand for {ekeinou ho,}, as in Simpl.'s paraphrase.—The meaning is that after the thing has ceased to be it still retains its capacity of existing at any time previous to that event.

†4 a comma is required after {enantiois} and, for {snnistatai}, {synistatai}.

†1 Omit {he kyklophoria}. The words are found only in L, and though harmless are quite superfluous. There is no reference to {kyklophoria} in Simpl.'s paraphrase.

†1 The cosmic motions must not be regarded as imposed upon the body of the cosmos by a world-soul as the human soul imposes movement on the human body. Such a notion necessarily implies constraint on the part of the body and effort on the part of the soul, and therefore the movement could not be eternal. Aristotle has in mind, no doubt, the world-soul of the *Timaeus*.

†2 Read {eiper kinei pheresthai pephykotos} . . . {allos kai kinei synechos}, with all MSS. except E. Simpl.'s paraphrase supports this reading.—The remarks which follow as to the absence of 'rational satisfaction' recall verbally Plato, *Timaeus* 36 E {theian archen erxato} [{he psyche}—the world-soul] {apaustou kai emphronos biou pros ton sympanta chronon}.

†3 By 'divination' ({manteia}) Aristotle means, not any religious practice of prophecy or the like, but simply the inspired guesses of common sense—{ten koinen tauten ennoian hen echomen peri tes aponias kai makariotetos tou theiou} (Simpl.).

†1 *De Incessu Anim.*, cc. iv, v.

†2 Prantl misprints {gan} for {gar}.

†3 Bekker and Prantl are probably right in regarding the words which follow {dexion} (viz. {kai} . . . {emprosthen}) as spurious, though they are found in all MSS. except E. There is no trace of them in Simpl. or Them.

†1 The right and left hands, for instance, differ in function but not in shape. It is implied that the difference of function underlies all the oppositions and determines the differences of shape where these occur. The differences of function are summarized above, 284b25-30.

†2 For the four main kinds of 'priority', see *Cat*. ch. xii (14a26 ff.). Additional distinctions are made in *Met*. {D} ch. xi.

†3 i.e. to animals. This is laid down at the beginning of the present chapter, 283b13, where reference is made to the *De Incessu Animalium*. Cf. also *Phys*. VIII. 4, 254b7.

†4 Bk. I, 279a28, where it is stated to be the source of all life and movement. The term 'animate' ({empsychos}) has not hitherto been applied to it. The notion that the stars are 'inanimate' is rejected below, 292a20.

†1 The unmoving poles mark out one among the infinite possible bisections of the sphere as natural and intelligible. We thus arrive, as explained in what follows, at an 'upper' and a 'lower' hemisphere.

†1 Heath (*Aristarchus*, pp. 231-2) summarizes the argument as follows: '"Right" is the place from which motion in space starts; and the motion of the heaven starts from the side where the stars rise, i.e. the east; therefore the east is "right" and the west "left". If now (1) you suppose yourself to be lying along the world's axis with your head towards the *north* pole, your feet towards the *south* pole, and your right hand towards the east, then clearly the apparent motion of the stars from east to west is over your *back* from your right side towards your left; this motion, Aristotle maintains, cannot be called motion "to the right", and therefore our hypothesis does not fit the assumption from which we start, namely that the daily rotation "begins from the right and is carried round towards the right ({epi ta dexia})". We must therefore alter the hypothesis and suppose (2) that you are lying with your head towards the *south* pole and your feet towards the *north* pole. If then your right hand is to the east, the daily motion begins at your right hand and proceeds over the front of your body from your right hand to your left.' Heath points out that to us this still gives a wrong result: the motion across your front will still be from right to left; but he accepts Simpl.'s explanation that movement to the front is regarded as rightward and motion to the back as leftward—{he gar epi dexia pantos eis to emprosthen esti}. If this is true, Heath's account is satisfactory. It is curious that the notion of rightward movement also gives trouble in the cosmology of Plato. Heath has an entirely different solution of that difficulty, in which the ordinary sense of 'to the right' is preserved (pp. 160-3). In view of the solution of the present passage quoted above, perhaps there is something after all to be said for the assertion of Proclus (*In Timaeum* 220 E), quoted by Heath only to be dismissed, that {epi dexia} does not mean {eis to dexion} but is confined to circular motion and means 'the direction of a movement imparted by the right hand' ({eph' ha to dexion kinei}). The discrimination of right and left in circular motions is peculiarly difficult and ambiguous, as every child knows; and some such use of {epi dexia} may have been the Greek solution of the terminological problem.

†1 The argument is clear. 'God' or 'divine' means 'eternal'. All body has motion. Therefore the notion of a divine body necessarily involves the notion of an eternal movement.—Simpl. says wrongly that {theos} here stands for {theion soma}.

†2 The nature of the circular motion, and the reasons why it alone is compatible with immutability and the other divine attributes, have been explained in Bk. I, chaps. iii and iv.—The adjective 'circular' ({enkyklios}) here and in several other passages of this book is transferred from the motion to the body endowed with it.

†3 The body which is at the centre cannot be of the same nature, and endowed with the same motion, as that which is at the extremity; for the actual position and movement of one or the other would in that case be unnatural. There must therefore be a body whose natural position is at the centre and whose natural movement is towards the centre.

†4 All change involves 'derangement' ({ekstasis}), *Phys*. 222b16: cf. *Phys*. 241b2. {ekstasis} is opposed to {teleiosis} ('fulfilment', or movement of a thing towards its ideal nature), *Phys*. 246a17, b2, 247a3.

†5 See ch. xiv.

†1 viz. air and water.

†2 See *De Gen. et Corr.* II. iii, iv.

†3 Retaining the MSS. reading, which is confirmed by Simpl. and Them., {touton d' esti kinesis}. If these words are taken to mean {tauta d' esti kineta} the argument, though summarily stated, is complete and Prantl's conjecture is unnecessary. If it is granted that the sublunary elements move, generation is admitted, unless it can be shown that their movement is such as to be naturally eternal. But it has already been shown (*Phys.* 261a31 ff.) that the rectilinear movements must be intermittent.

†4 A. is proving the necessity of the secondary revolution, i.e. that of the planets. 'If', he argues, 'there were only the movement of the fixed stars, and sun and moon were set in it and carried along with it, the varieties of summer and winter and the other seasons would disappear and the daily interchange would not follow its accustomed course. For if the sun were set in Cancer, we should have perpetual summer, and if it were set in Capricorn, perpetual winter: there would be no generation or destruction, not even the varied phases of the moon' (Simpl.). The further discussion promised here is to be found in *De Gen. et Corr.* II. x.

†1 *Phys.* III. 207a8. For the terms of the definition cf. *sup.* 271b31. This notion of 'perfect' (or 'complete') is presupposed in the opening chapter of this treatise.—In l. 19 read {ton autou}: the {ton} is omitted only in E and F.

†2 Cf. *Phys.* VI. 1 and *inf.* Bk. III, ch. i for further criticisms of these theories. The theory criticized is that expressed by Timaeus the Pythagorean in Plato's dialogue of that name. (So Simpl. on 298b33.)

†3 Prantl's {mone} is a misprint for {monen}.

†4 Both sphere and circle can of course be divided into parts, but they cannot be geometrically analysed into constituents not themselves spherical or circular. The geometrical analysis requires that the constituent or 'part' shall be different in form from the whole.

†1 This depends, as Simpl. observes, after Alexander, on the position of the axis of revolution. In the case of a perfect sphere alone the position of the axis is immaterial.

†2 Reading {aph' eautou eph' eauto}, with Simpl. and the consensus of the MSS. The {tou} and {to} in Prantl's text are conjectural insertions. J has {aph' autou eph' auto}.

†1 This is true if equality of effort ({apo tes autes dynameos} Simpl.) is postulated. In a word, the underlying notion is rather the comparative *economy* than the comparative *swiftness* of movements.—For the origin of this argument Simpl. refers to *Tim.* 33 B.

†2 'Continuous', 'contiguous', and the related terms are defined in *Phys.* V. iii. If these bodies were continuous with the heavenly body they would have to move with the same motion as it.

†3 [FIG. ABCDE]

†1 If *a* is the 'right from which movement starts, why should the movement be towards *B* rather than *a* towards *C?* Probably, answers Aristotle, because movement towards *B* is 'forward' and movement towards *C* 'backward' motion.

†2 I. iv.

†3 Bekker and Prantl prefer L's {karterikoteron} to the {karteroteron} of all other MSS. It is difficult to

imagine why. There is good Platonic parallel for the use of {karteros} in this connexion (*Phaedo* 77A, *Theaet*. 169B).

†4 a similar caution is repeated at the beginning of ch. xii, 291b25. For this use of {phainomenon} cf. Bonitz, *Ind. Ar*. 809a24.

†5 Reading, with Prantl, {echei de eiper}, and accepting his punctuation. The passage as punctuated by Bekker is untranslatable. The apodosis undoubtedly begins at the word {echei}. EL give {echei de eiper}, the remaining MSS. {echei eiper}.—The existence of a 'front' and 'back' in the world was asserted in ch. ii. The priority of 'up', 'right', and 'front' over 'down', 'left', and 'back' is assumed in the same chapter, 284b24. —The gist of the present rather involved and hesitating statement is that the only way to account for the direction of the heavenly movements is by means of these oppositions and the priority commonly attributed in each to one term over the other.

†1 It appears from *Meteorologica* I. iv, 341b—342a that meteors and shooting stars come under the notion of 'missiles' or 'things thrown'. Their motion is compared to that of the stone of a fruit when it is made to fly through the air by being squeezed out from between the fingers. Ordinary throwing, e.g. of a stone or javelin, would of course also be included.—Simpl. and, by his report, Alexander are much puzzled by the statement in the text. Simpl. makes the wild suggestion that A. here regards animal movements as 'missile' motion, in that they are neither upward nor downward but horizontal. Alex. suggests that 'missile' movements may be said to have their maximum between goal and starting-point, because every earthly body has its goal either up or down, and the whole of the 'missile' movement, from beginning to end, takes place in the middle region. Alex. is probably right. It is to be remembered that all movement is either natural or unnatural, and that 'missile' movement can only be distinguished in principle as a mixture of the two; further that the body thrown must be composed of one or more of the four elementary bodies. 'Throwing' is thought of as a forced horizontal motion put upon one of these bodies, each of which has a 'goal', down (or up), and a 'starting-point', up (or down). In such a motion the maximum cannot be said to be attained at either terminus, since neither terminus is involved, but only 'between the two'. This means that in the case of natural motion 'goal' must be taken to be the natural place of the body, which is also the 'starting-point' of unnatural motion in the same body. In 'throwing', therefore, there is neither starting-point nor goal, but all is in the intermediate region.

†1 For {gegonei} read {egegonei} with FHLMJ.

†1 Reading {oud' holos}, with all MSS. except E, which Prantl follows in reading {oud' allos}.—The effect of {allos} is to make the unnatural one species or department within the general notion of incapacity. {holos} has much more varied uses and enables one to avoid this implication.

†2 i.e. equality of duration must be supposed between the incapacity (retardation) and the preceding capacity, as assumed in the foregoing argument, in which infinity (sc. in *one* direction) is attributed to each. For if the speed of movement has been everlastingly increasing, and now begins to decrease, it is impossible to suppose anything else but that it will decrease everlastingly.

†3 viz. in respect of its speed. The hypothesis now considered is retardation or acceleration not balanced by its opposite but having neither beginning nor end, i.e. infinite in *both* directions.

†4 Prantl's stopping needs correction. The words {ei de me} . . . {thateron} should be enclosed within brackets.

†1 i.e. of the same substance as the spheres to which their motion is due.

†2 a colon is required after the word {aer} in l. 23.

†3 {plege} seems to stand here for the continuous beating of the missile upon the air rather than for a single blow. Cf. Simpl. 439. 25 {hypo tes} . . . {pleges kai paratripseos}. The same use recurs below, 291a17.

†1 The stars are not themselves ignited because the substance of which they are composed cannot be transmuted into any other as fire, air, and the other sublunary substances can. It is, however, legitimate to object to the above account that fire, not air, is the substance in contact with the spheres, and that only with the innermost. How, then, is air ignited by the movement of the spheres? Alex. and Simpl. agree that 'air' must in some sense include fire (or {hypekkauma}, the 'fuel of fire' which occupies the outer place); but that, even if true, will not solve the difficulties. The view here advanced is nowhere fully worked out; but some further suggestions are made in *Meteor*. I. iii and iv. Cf. Heath, *Aristarchus*, pp. 241-2. It seems certain that what Aristotle meant was that the 'fire' which is in contact with the spheres is ignited and agitated by their motion and the air beneath by it (341a2-3 and 30-31).

†1 Bekker and Prantl read {tauta} instead of {ta auta}, which is the reading of all MSS. and of Simpl. The alteration is unnecessary. The difficulty is the same as that pointed out in the preceding argument—an unaccountable correspondence between the size of the circle and the speed of the star's movement.

†1 Cf. c. iv. But there is no attempt to prove continuity in the *De Caelo*.

†2 By 'spinning' is meant rotation on a stationary axis, by 'rolling' a forward movement in which a body turns completely round in a distance equal to its own circumference. See Heath, *Aristarchus*, pp. 233-5.

†3 The term {opsis} (= visual ray) belongs to pre-Aristotelian psychology. Cf. Plato, *Meno*, 76 C-D. Aristotle's use of it here and elsewhere (e.g. *Meteor*. III. iv, 373b2) seems to commit him 'to the view that the eye sees by rays issuing from a native fire within it' (Beare, *Greek Theories of Elementary Cognition*, p. 66, n. 1). But his own argument, when dealing with vision, is to the contrary effect. 'In seeing we take something in, not give something out' (*Top*. 105b6); and the process is 'from object to eye, not conversely' (Beare, p. 86). Aristotle must be supposed here to be adopting popular or Platonic terminology.

†1 It has been objected to Aristotle that if the moon always shows the same side to us it is thereby proved that it does rotate upon its axis. But such rotation (incidental, in Aristotle's view, to the movement of the sphere) is quite different from the rotation involved in 'rolling', which Aristotle is here concerned to deny. See Heath, p. 235.

†2 The doctrine of the 'harmony of the spheres' is no doubt, as Simpl. says, Pythagorean. The most famous statement of the doctrine is in Plato's *Republic* (Myth of Er, 617B), and the ratios given to the planets in *Timaeus*, 35B, seem to have a musical significance. For a discussion of the doctrine see Heath, *Aristarchus*, pp. 105-15.

†1 Prantl misprints {diaknaien} for {diaknaiein}.

†2 If the stars moved in a non-moving medium either with a self-originated motion, like that of an animal, or with a motion imposed on them by external force, like that of a stone thrown, a great and destructive noise would result. There is no such noise or destruction. Therefore they do not so move. The Pythagorean doctrine is thus used to corroborate a conclusion already reached. It might be objected that Aristotle has already postulated friction with another substance to account for the brightness of the stars, and that this friction might well be expected to be accompanied with noise as in the case of missiles on the earth.

†3 The tone of this reference to 'astronomy', as well as the present tense in the verb {legetai} suggest that Aristotle is not here referring to other works of his own but to contemporary works on astronomy, current in the school, by other writers. These sentences also clearly imply that 'astronomy' is more empirical in its methods than the *De Caelo*. Cf. *infra*, 291b21.—In l. 29 Prantl's {ho} is a misprint for {hon}.

†1 In regard to 'order' Aristotle only seeks to explain one point which might present a difficulty. It would be natural to expect the moon, which is the nearest planet to the earth, to have the slowest motion; but in fact it is the swiftest of the planets. His answer is that the movement of the planets, being the reverse of that of the outer heaven, is hampered by proximity to it; and the planet nearest to the earth is least influenced and therefore moves swiftest. Simpl. raises the objection: is not the planetary motion then in some degree constrained or unnatural? He quotes with approval from Alex. the reply: 'No: for the planetary sphere is not unwilling. This accords with its purpose and desire. It may be necessity, but it is also good, and recognized as such.' Simpl. is not altogether satisfied by this solution.

†2 Ch. viii.

†3 Simpl. notes a circle in Aristotle's argument, since he has already used the spherical shape of the stars to prove that they have no independent motion (c. viii). (The same charge is brought against Aristotle by Dreyer, *Planetary Systems,* p. 111.) He is not satisfied with Alex.'s rejoinder that neither of these arguments stands alone. The true answer is that the argument of c. viii is explicitly based, in respect of the spherical shape of the stars, on a premise borrowed from the opposition: see 290a7. Aristotle's own proof of the matter precedes it. This argument is therefore in order.

†1 See note on 291a32.

†2 See note on 288a2.

†3 Brandis (Berlin Aristotle, vol. IV, 497b13) quotes a scholium to the effect that Alexander in his Commentary said it was Mercury, not Mars. Both Simpl. and Them., however, give Mars without question. If it was Mars, a calculation of Kepler's (*Astronomia Nova*, 1609, p. 323) fixes the date. 'Inveni,' he writes, 'longissima inductione per annos L, ab anno quindecimo ad finem vitae Aristotelis, non potuisse esse alio die, quam in vespera diei IV Aprilis, anno ante CHRISTI vulgarem epocham CCCLVII, cum Aristoteles XXI annorum audiret Eudoxum, ut ex Diogene Laërtio constat.' Diogenes' date for Aristotle's birth is in fact Ol. 99, 1 (384-3 B.C.): Aristotle would therefore be 27 at the date arrived at. The calculation for Mercury does not appear to have been made.

†1 See note on 270b14.

†2 i.e. the planets.

†3 The term {phora} (motion) is transferred from the motion itself to the sphere which imparts the motion.

†4 There seems to be no parallel for the use of the word {konisis} (tr. 'hard training') in connexion with the exercises of the palaestra, though {konistra} is used in post-Aristotelian writers for the arena. Simpl. says the term stands for the training of the wrestler, {dia to en konei gymnazesthai ta palaistrika}. Bywater (*J. of Phil*. xxviii, p. 241) objects that the third term in the phrase should be a distinct form of exercise from running or wrestling, and suggests {kakontiseos}. Perhaps it is best to keep the text, though there can be no certainty that it is right.

†1 Prantl's {Koous} rests on one MS. (H) and was known as an alternative reading to Simpl. Two MSS. (EL) give {Chious}, two others (FM) {chious e koous}. J has {chilious cholous} with {chious e koious} in the margin. Simpl. thinks the point is the size of the dice ({hos megalon astragalon en amphoterais ginomenon tais nesois}). Prantl takes the impossibility to be a succession of good throws or 'sixes', and therefore prefers 'Coan' to 'Chian', which according to Pollux was used for the worst throw. The impossibility is clearly the same whether the worst throw or the best is intended; but, since success is implied by the context, I have followed Prantl. The double reading {Chious e Koous} may however be right.

†2 Reading {prattei}, with FHMJ and Bekker, for Prantl's {prattein} (EL).

†3 The long parenthesis (l. 3 {pollon gar} to l. 7 {heneka}) in Prantl's text breaks the structure of the sentence and should be removed. The succession of colons which results (for a colon must be marked after {praxeis} in l. 3) is best broken by placing full-stops after {phyton} (l. 2), {heneka} (l. 4), {heneka} (l. 7).

†4 If there is more than one good, e.g. nutriment and propagation, each is a constituent of the plant's 'good' in the final sense. To be able to accept something merely as a means to something else, i.e. as indirectly good, is a distinctive mark of a higher development. Thus the variety here indicated as characteristic of human action lies not so much in the superior range of human desires (though that also is a fact) as in the variety and complexity of the means by which man effects their satisfaction.

†1 Reading {euphys} for {engys}. Cf. l. 20 below. {engys} is in all the MSS., but is quite intolerable in view of the general contrast between attainment and approximation made here and repeated below. The influence of {engys} in the following line may be supposed to have caused its substitution for {euphys} here. Simpl. paraphrases {to de di' oligon kineseon aphikneitai pros to eautou telos}, and therefore appears not to have had {engys} in his text. Them., however, has it: 'ad illud prope per pauca accredit.'

†2 Place a full-stop after {elphein} (l. 13), delete bracket, comma after {ischnanphenai} (l. 17). 'Running' or 'reduction of flesh' becomes in such a case the 'end', i.e. the content of purpose, as soon as the true end or good is recognized as unattainable.

†3 Simpl. finds this sentence difficult. He did not see that Aristotle here, as frequently elsewhere, uses {alla} where {all' e} would be expected. See Bonitz, *Ind. Ar.* 33b15.

†4 The upshot of the argument seems to be this, that the earth and the bodies nearest to it move simply, or not at all, because they are content with little, and perfection is beyond their reach.

†1 The movements of each planet are analysed into the combination of a number of simple spherical motions each contributed by a single sphere. The 'last' sphere or motion means the outermost, viz. that to which the planet is actually attached. The inner spheres have really bodies to move even though they carry no planet: for they have to communicate their motion to the sphere or spheres in which they are included.

†2 Prantl seems to find unnecessary difficulty in this sentence. These spheres, says Aristotle, have only a limited force, and they have enough to do to impart their motion to the outer spheres, and through it to the planet: the burden of several planets would be too much for them.

†1 {onoma} is omitted by FHMJ, but is probably right.

†1 {med'} in l. 18 appears to prove that the comma should be put after {keisthai} instead of after {auten} and that {phasin} governs both infinitives.

†2 Prantl's insertion of {me} in the last clause rests on a misunderstanding of the passage. The text is quite sound.—Dreyer (*Planetary Systems,* p. 45) thinks that the supposed movement would seriously affect observations of the sun and the moon.

†3 *Timaeus,* 40 B. For a discussion of this vexed passage see Heath, *Aristarchus,* pp. 174-8. J has {eileisthai kai kineisthai} (in 296a26, however, where the same pair of words recur, it has {eillesthai k. k.}), which decreases the probability, not antecedently very great, that the words {kai kineisthai} are an insertion. Unless the idea of movement is contained in the phrase, the quotation would seem to be out of place here. It seems plain that Aristotle considered the word {illesthai} ('rolled' in the text) obscure or ambiguous, and added the words {kai kineisthai} to indicate his interpretation of it. Alex. (*apud* Simpl.) says that the word used in the *Timaeus* means 'pressed' ({biazesthai}), but that it is difficult to contradict

Aristotle on a point on which he was so much better informed. Simpl. says that, spelt with the diphthong {ei} and a single {l}, the word does connote rotation. He points out that Aristotle promised to speak of the earth's motion *and rest;* and suggests that, taking {kai kineisthai} to be a later insertion, one might suppose that Aristotle passes in this sentence to the consideration of the view that the earth is at rest. But this will hardly do.

†1 Diels, *Vorsokratiker*@3, 11 A47 (53, 38 ff.), B28 (63, 8). Ritter and Preller, 103b. Simpl. cannot find the quotation in the writings of Xenophanes, and doubts whether {to kato tes ges} means 'the underparts of the earth' or 'the ether under the earth'. a fragment corroborating the former interpretation survives (no. 28 in Diels). Cf. Burnet, E.G.P.@3 § 60.

†2 Diels, *Vors.*@3 21 B39 (241, 16). Ritter and Preller, 103 b. Burnet, E.G.P.@3 p. 212.

†1 The objections must be 'proper to the kind' or class to which the subject of investigation belongs, i.e. scientific, not dialectical or sophistical. These thinkers, as Simpl. observes, have failed to investigate the peculiar characteristics of wood and earth in the genus 'body', and therefore think that, because wood floats, earth may. For the importance of a study of the 'differences' Simpl. refers to *Top*. I. xviii.

†1 Reading {hoster} with the MSS. Diels (*Vors.*@3 25, 32) inserts {tou} before {metastenai} (l. 19), a conjecture which has some support in L, which has {pou} in that place.—-Experiments with the water-clock are frequently mentioned. See esp. Emped. fr. 100 (Diels), Arist. *Probl*. 914b26, Burnet, E.G.P.@3 Index I s.v., Klepsydra. 'The water-clock', says Simpl., 'is a vessel with a narrow mouth and a flattish base pierced with small holes, what we now call a *hydrarpax*. If this vessel is dipped in water while the mouth at the top is kept closed, no water runs in through the holes. The massed air inside resists the water and prevents its ingress, being unable to change its own place. When the mouth at the top is opened the water runs in, the air making way for it.' The position of the water beneath the water-clock is analogous to that of the air beneath the earth.

†2 i.e. to the single element earth or to earth and air.

†3 I. ii-iv.

†1 Simplicius seems to be right in considering the portion included within brackets in the text as a parenthetic note on {dinesis}, interrupting Aristotle's argument.

†2 The sense required is 'withdrawn', as above, but there is no parallel to the use of {hypelthein} in this sense. The MSS. offer no variant, and Simpl. paraphrases {ekstantos}. In the absence of a better suggestion I should read {hypexelthontos}.

†3 The suggestion clearly is that, consciously or unconsciously, these thinkers attributed a natural motion downward to the earth, since they gave it a reason for not moving in that direction only.

†1 Read {kai to kouphon} with all MSS. except E.

†2 Literally 'likeness'. Kranz, Index to Diels, *Vors*., s.v. {homoiotes}, translates 'gleichmässige Lage'. Burnet (who formerly took a different view) now accepts 'indifference' as the equivalent of {homoiotes} in this passage. (E.G.P.@3 p. 66, n. 1.) Cf. Burnet's note on Plato, *Phaedo*, 109 a 2, where he proposes the translation 'equiformity', and the phrase {pros homoias gonias} below (296b20). From Aristotle's wording it seems probable that he had the *Phaedo* in mind here. The full phrase there is: {ten homoioteta tou ouranou autou heauto pante kai tes ges autes ten isorropian}. It is to be observed that Plato makes {homoiotes} an attribute of the whole heaven or universe, not of the earth.

†3 Prantl's {enaution} is a misprint for {enantion}.

†1 The structure of the sentence would be made clearer if commas were placed after {men} and after {de} in l. 33.

†2 The principle is in fact true, if it is properly understood, i.e. seen to apply, as explained in what follows, only to indivisible bodies.

†1 For {illesthai} has {eillesthai}. See note on 293b31.

†2 This passage is examined in Heath, *Aristarchus*, pp. 240-1. The necessity for two motions appears to rest only on the analogy of the planets, which are 'passed' or left behind by the motion of the sphere of the fixed stars. The consequence, that there would be variety in the places of rising and setting of the fixed stars, follows from the assumption of a second motion, if the second is taken to be oblique to the first (Heath, *loc. cit.*).

†1 i.e. at right angles to a tangent: if it fell otherwise than at right angles, the angles on each side of the line of fall would be unequal. Cf. *inf.* 311b34, where the argument is repeated. The phrase {pros homoias gonias}, 'at *like* angles', appears to strike Simpl. as a rather strange equivalent for {pros isas gonias}, 'at *equal* angles', borrowed, as he says, from those who referred 'angle' to the category of quality—{homoias de ekaloun tas isas gonias oi ten gonian hypo to poion anagontes} (538, 22). Cf. Burnet's remarks on {homoiotes} in *Phaedo*, 109 a 2, quoted in part above in note on 295b11.

†2 It seems plain that the words {kata stathmen} ('quite straight') refer to the line of the throw, not, as Simpl. supposes, to the line of return. But it is difficult to see what independent test Aristotle had of the straightness of the throw.

†1 The sense of the sentence is, clearly, 'the phenomena are accounted for on the present hypothesis: why change it?' But the precise relevance of (apparent) changes of shape does not seem clear. Simpl. illustrates by changes which would be necessitated by the hypothesis of a moving earth; but his own paraphrase of Aristotle's words implies that the changes in question are *observed* changes. The Greek implies (1) that the order of the stars is settled by the apparent shapes or patterns which they make in combination; (2) that the changes of these shapes are accounted for on the hypothesis of a stationary earth.

†2 {synchorein} is clearly used here of 'convergence', not, as Prantl translates, of 'making way'. So Simpl. paraphrases, {symplattetai e synchorei heteron hetero}.

†3 The cosmogony which follows is in principle that of Anaxagoras (Burnet, E.G.P.@3 § 133).

†1 The words 'at the centre' in the first clause seem intrusive at first sight; and logically they are indefensible. 'Either the earth will not stay still at the centre, or, if it does stay still at the centre, it will not have its (new) centre at the centre which is its natural goal!' The words {epi tou mesou} then, may be an insertion. They are, however, more probably due to the desire for a direct contradictory. The view is {menei epi tou mesou} the contradictory is therefore {ou menei epi tou mesou}: and the {eiper} recalls only the {menei}. Either it does not *stay still* at the centre or it doesn't stay still *at the centre*.'

†1 The argument is quite clear if it is understood that 'greater' and 'less' here and in a 30 and in b5 stand for greater and smaller portions of one body, the line of division passing through the centre which is the goal. Suppose the earth so placed in regard to the centre. The larger and heavier division would 'drive the lesser forward', i.e. beyond the centre (a30); it would 'prevail until the body's centre occupied the centre' (b5); it would 'force the less to equalize itself', i.e. to move on until the line passing through the central goal divided the body equally. Simpl. fails to see this.—Alex. (*ap*. Simpl. 543, 15) raises the difficulty that the final movement of the 'less' will be away from the centre, or upward, and hence unnatural. But this is to make a perverse abstraction of part from whole. The desire of earth to reach the centre can never be fully

satisfied, since the centre is a geometrical point.

†2 See note on 296b20.

†3 Allowing for scruples due to the evident inequalities of the earth's surface.

†1 Simpl. gives, for the benefit of 'those who doubt the wisdom of the ancients', a summary account of the methods by which this result was attained.—This appears to be the oldest recorded estimate of the size of the earth. 400,000 stades = 9,987 geographical miles. Other estimates (in miles) are: Archimedes, 7,495; Eratosthenes and Hipparchus, 6,292; Poseidonius, 5,992 or 4,494; present day, 5,400. (These figures are borrowed from Prantl's note on the passage in his translation, p. 319.)

†1 Aristotle speaks of the four sublunary elements as two, because generically they are two. Two are heavy, two light: two move up and two down. Books III and IV of this treatise deal solely with these elements.

†1 The reference, according to Simplicius, is to Orphic writings ('the school of Orpheus and Musaeus').

†2 e.g. Thales, Anaximander, Anaximenes.

†3 'The view of Timaeus the Pythagorean, recorded by Plato in the dialogue named after him' (Simpl.). The theory criticized is certainly that advanced in the *Timaeus,* and is usually attributed to Plato, as by Zeller, *Ph. d. Gr.*@4 II. i, p. 804, but Aristotle probably has also in mind certain members of the Academy, particularly Xenocrates (*ib.,* pp. 1016 ff.).

†4 The promised discussion is not to be found in the *De Caelo* nor in its sequel, the *De Generatione et Corruptione.* But Aristotle has already devoted some attention to these views at the beginning of the *Physics,* and there is also the discussion of *Met.* A.

†1 *Phys.* VI. i.

†2 The reading {diaireton} though preserved only in one rather inferior manuscript, must be preferred on grounds of sense to the {adiaireton} of the other manuscripts. The silence of Simplicius seems to corroborate the reading {diareton}. Possibly the clause is a gloss.

†3 i.e. not divisible into kinds.

†1 Prantl's conjecture {e toudi} is unsatisfactory. The alternatives are (1) to keep the reading of the manuscripts ({e todi}), (2) to read {toudi}, omitting {e}. In the latter case the sense remains the same but the construction becomes rather easier.

†2 Prantl's conjectural duplication of the words {mia stigme}, though harmless, is unnecessary.

†1 i.e. so as to form pyramids, cubes, &c.

†2 Grammar requires the readings {epitithemene, prostithemene} instead of the {epitithemenen, prostithemenen} of all manuscripts but one (M).

†3 Because they will not be pyramids or instances of any other recognized figure.

†4 Omitting the {ta} before {ton epipedon}, which got into E by a simple dittography and is found in no other manuscript.

†5 Plato, *Tim.* 56 B.

†6 i.e. point : line :: line : plane :: plane : body (as below).

†1 This is in verbal contradiction with the doctrine of Book I, which asserts that the unnatural movement is single since it is the contrary of the natural, which is single. But it is not difficult to conceive of all movements of a body divergent from the one natural path as unnatural according to the degree of their divergence, even though, strictly construed, the unnatural path is also one.

†2 This question, though relevant to the general problem, is not *specially* relevant to the hypothesis that the obstacle is in movement. There is therefore something to be said for an interpretation which, like that attributed by Simplicius to Alexander, makes the question refer to the supposed moving obstacle instead of to the earth. But Alexander's interpretation turns out on examination to create more difficulties than it removes: and there is no great objection, after all, to supposing that Aristotle refutes the second alternative by an argument which refutes both.

†1 Plato, *Tim*. 30 a.

†2 Taking the reading for which Alexander argued—{kinein auto kinoumenon kata physin}. I should put a comma after {kinein} and take {kata ph.} with {kinoumenon}. The hypothesis is that the elements have their natural movements; and the dependent clause {auto kin. k. ph.} applies this hypothesis to the prime mover, as {ta kinoumena me bia} applies it to the other bodies. Aristotle shows that, on this hypothesis, the present world-order would exist: the prime mover would be imparting movement to the bodies within it, as it does now, and the four elements would be moving towards or resting in their proper places, as now. If {auto} is read, we have a more disputable description of this {kosmos} and less use for the words {kinoumenon kata physin}. {auto} is said to be the reading of the manuscripts, but neither copyists nor collators are to be trusted with a breathing. J has {auto} *(sic)*.

†1 Emped. fr. 57, l. 1 (Diels, *Vors*.@3 245, 20).

†2 Reading {symbainei}, with HMJ, for {symbainein}.

†3 Putting a comma instead of a full-stop after {stoicheion} (l. 19).

†4 The proposition to be proved is that *some* bodies have *necessarily* this kind of impetus. The introduction of necessity shows that we are dealing with a universal. Below in 301b16, and again in 301b30, we are told that *every* body is either light or heavy. Aristotle's readers would of course understand that the disjunction only applied universally 'beneath the moon'. The more cautious statement in this passage allows for the exception of the heavenly body.

†1 Reading {protethentos} which is given by all manuscripts except M and by Simplicius.

†2 i.e. not infinite. {diorismenon} is here equivalent to {horismenon}. a similar tendency is observable in other derivatives of {diorizein}, e.g. {adioristos}. Alexander and Simplicius made great, but not very successful, efforts to interpret the word as qualifying 'body': they do not consider the possibility of its qualifying {baros e kouphoteta}. Probably their manuscripts, like FHMJ, had {to} before {diorismenon} which would make it difficult or impossible to take {diorismenon} in that way.

†1 Reading {e he allo}. It looks as if Simplicius had this reading (see critical note to Heiberg's edition, p. 595, 22): his interpretation requires it.

†2 Reading {thatto} in l. 20, with all manuscripts except F and with Simplicius. {aute} in 22 is somewhat vague in reference, but must stand for {he dynamis aute}.

†3 ll. 23-5, {pephyke} . . . {barys} are grammatically a parenthesis, and should be so printed, with a colon

in 23 after {barys}. For the doctrine cf. *Phys*. IV. 8 and VIII. 10.

†4 Simplicius and Alexander, with three of our manuscripts (FHM), have {en toutois} for {ek touton}. {en toutois} would go with {echousi} rather than with {phaneron} qualifying the application of the second clause. The qualification, however, cannot be made very precise, and it is best to follow the other three manuscripts.

†5 The {gar} which introduces the next sentence shows that the justification of the statement is to come. The thesis follows from what was 'said earlier', because in *Phys*. IV. 6-9 the hypothesis of a void was investigated and refuted, and it is here shown that absolute generation, or generation of body out of not-body, requires a void. The nature of the heavenly body and the views of Parmenides and Melissus, referred to by Simplicius, are not here in point.

†1 i.e. a void outside bodies, as distinct from the fragments of void which are supposed to be distributed throughout the texture of every body. Simplicius attributes the distinction of two kinds of void to the authors of the theory themselves.

†2 Reading in l. 2 {to ginomenon, ei egeneto} with Bekker. The manuscripts are confused, and offer many variants.

†3 viz. bodies subject to generation. We read {poian ton toiouton} with the manuscripts, taking {ton toiouton} as a partitive genitive (after Simplicius).

†1 'Homoeomerous' means 'having parts like one another and like the whole of which they are parts'. Some confusion is here caused by the fact that Aristotle sometimes uses 'homoeomerous' as an attribute of the parts of a homoeomerous whole, i.e. as meaning 'like one another and like the whole of which they are parts'. That is what he means when he says of a body (302b16) that it is 'divisible into homoeomerous parts' or (*ib*. 25) that it is 'composed of homoeomerous bodies'. The use of the term {lepromeres} (= {mikromeres}) is complicated by a similar transference from whole to part (cp. 304b9, note).

†2 Cp. Book 1, 270b24.