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Science of Mechanics in the Middle Ages

MARSHALL CLAGETT

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Document 8.2

John Buridan, *Questions on the Eight Books of the Physics of Aristotle**

1. BOOK VIII, QUESTION 12. It is sought whether a projectile after leaving the hand of the projector is moved by the air, or by what it is moved.

It is argued that it is not moved by the air, because the air seems rather to resist, since it is necessary that it be divided. Furthermore, if you say that the projector in the beginning moved the projectile and the ambient air along with it, and then that air, having been moved, moves the projectile further to such and such a distance, the doubt will return as to by what the air is moved after the projector ceases to move. For there is just as much difficulty regarding this (the air) as there is regarding the stone which is thrown.

Aristotle takes the opposite position in the eighth[41] [book] of this work (the *Physics*) thus: "Projectiles are moved further after the projectors are no longer in contact with them, either by antiperistasis, as some say, or by the fact that the air having been pushed, pushes with a movement swifter than the movement of impulsion by which it (the body) is carried towards its own [natural] place." He determines the same thing in the seventh and eighth [books] of this work (the *Physics*) and in the third [book] of the *De caelo*.

2. This question I judge to be very difficult because Aristotle, as it seems to me, has not solved it well. For he touches on two opinions. The first one, which he calls "antiperistasis," holds that the projectile swiftly leaves the place in which it was, and nature, not permitting a vacuum, rapidly sends air in behind to fill up the vacuum. The air moved

* Translated from the edition of Paris, 1509, with the modification of A. Maier, *Zwei Grundprobleme der scholastischen Naturphilosophie*, 2d ed. (Rome, 1951), pp. 201–14.

[41] This is a statement from the fourth book rather than the eighth book; see footnote 1 above.

swiftly in this way and impinging upon the projectile impels it along further. This is repeated continually up to a certain distance . . . . But such a solution notwithstanding, it seems to me that this method of proceeding was without value because of many experiences *(experientie)*.

The first experience concerns the top *(trocus)* and the smith's mill (i.e. wheel—*mola fabri*) which are moved for a long time and yet do not leave their places. Hence, it is not necessary for the air to follow along to fill up the place of departure of a top of this kind and a smith's mill. So it cannot be said [that the top and the smith's mill are moved by the air] in this manner.

The second experience is this: A lance having a conical posterior as sharp as its anterior would be moved after projection just as swiftly as it would be without a sharp conical posterior. But surely the air following could not push a sharp end in this way, because the air would be easily divided by the sharpness.

The third experience is this: a ship drawn swiftly in the river even against the flow of the river, after the drawing has ceased, cannot be stopped quickly, but continues to move for a long time. And yet a sailor on deck does not feel any air from behind pushing him. He feels only the air from the front resisting [him]. Again, suppose that the said ship were loaded with grain or wood and a man were situated to the rear of the cargo. Then if the air were of such an impetus that it could push the ship along so strongly, the man would be pressed very violently between that cargo and the air following it. Experience shows this to be false. Or, at least, if the ship were loaded with grain or straw, the air following and pushing would fold over *(plico)* the stalks which were in the rear. This is all false.

3. Another opinion, which Aristotle seems to approve, is that the projector moves the air adjacent to the projectile [simultaneously] with the projectile and that air moved swiftly has the power of moving the projectile. He does not mean by this that the same air is moved from the place of projection to the place where the projectile stops, but rather that the air joined to the projector is moved by the projector and that air having been moved moves another part of the air next to it, and that [part] moves another (i.e., the next) up to a certain distance. Hence the first air moves the projectile into the second air, and the second [air moves it] into the third air, and so on. Aristotle says, therefore, that there is not one mover but many in turn. Hence he also concludes that the movement is not continuous but consists of succeeding or contiguous entities.

But this opinion and method certainly seems to me equally as impossible as the opinion and method of the preceding view. For this method cannot solve the problem of how the top or smith's mill is turned after the hand [which sets them into motion] has been removed. Because, if you cut off the air on all sides near the smith's mill by a cloth *(linteamine)*, the mill does not on this account stop but continues to move for a long time. Therefore it is not moved by the air.

Also a ship drawn swiftly is moved a long time after the haulers have stopped pulling it. The surrounding air does not move it, because if it were covered by a cloth and the cloth with the ambient air were withdrawn, the ship would not stop its motion on this account. And even if the ship were loaded with grain or straw and were moved by the ambient air, then that air ought to blow exterior stalks toward the front. But the contrary is evident, for the stalks are blown rather to the rear because of the resisting ambient air.

Again, the air, regardless of how fast it moves, is easily divisible. Hence it is not evident as to how it would sustain a stone of weight of one thousand pounds projected in a sling or in a machine.

Furthermore, you could, by pushing your hand, move the adjacent air, if there is nothing in your hand, just as fast or faster than if you were holding in your hand a stone which you wish to project. If, therefore, that air by reason of the velocity of its motion is of a great enough impetus to move the stone swiftly, it seems that if I were to impel air toward you equally as fast, the air ought to push you impetuously and with sensible strength. [Yet] we would not perceive this.

Also, it follows that you would throw a feather farther than a stone and something less heavy farther than something heavier, assuming equal magnitudes and shapes. Experience shows this to be false. The consequence is manifest, for the air having been moved ought to sustain or carry or move a feather more easily than something heavier . . . .

4. Thus we can and ought to say that in the stone or other projectile there is impressed something which is the motive force *(virtus motiva)* of that projectile. And this is evidently better than falling back on the statement that the air continues to move that projectile. For the air appears rather to resist. Therefore, it seems to me that it ought to be said that the motor in moving a moving body impresses *(imprimit)* in it a certain impetus *(impetus)* or a certain motive force *(vis motiva)* of the moving body, [which impetus acts] in the direction toward which the mover was moving the moving body, either up or down, or laterally, or circularly.

*And by the amount the motor moves that moving body more swiftly, by the same amount it will impress in it a stronger impetus.** It is by that impetus that the stone is moved after the projector ceases to move. But that impetus is continually decreased *(remittitur)* by the resisting air and by the gravity of the stone, which inclines it in a direction contrary to that in which the impetus was naturally predisposed to move it. Thus the movement of the stone continually becomes slower, and finally that impetus is so diminished or corrupted that the gravity of the stone wins out over it and moves the stone down to its natural place.

This method, it appears to me, ought to be supported because the other methods do not appear to be true and also because all the appearances *(apparentia)* are in harmony with this method.

5. For if anyone seeks why I project a stone farther than a feather, and iron or lead fitted to my hand farther than just as much wood, I answer that the cause of this is that the reception of all forms and natural dispositions is in matter and by reason of matter. *Hence by the amount more there is of matter, by that amount can the body receive more of that impetus and more intensely* (intensius). *Now in a dense and heavy body, other things being equal, there is more of prime matter than in a rare and light one. Hence a dense and heavy body receives more of that impetus and more intensely, just as iron can receive more calidity than wood or water of the same quantity.* Moreover, a feather receives such an impetus so weakly *(remisse)* that such an impetus is immediately destroyed by the resisting air. *And so also if light wood and heavy iron of the same volume and of the same shape are moved equally fast by a projector, the iron will be moved farther because there is impressed in it a more intense impetus, which is not so quickly corrupted as the lesser impetus would be corrupted. This also is the reason why it is more difficult to bring to rest a large smith's mill which is moving swiftly than a small one, evidently because in the large one, other things being equal, there is more impetus.* And for this reason you could throw a stone of one-half or one pound weight farther than you could a thousandth part of it. For the impetus in that thousandth part is so small that it is overcome immediately by the resisting air.

6. From this theory also appears the cause of why the natural motion of a heavy body downward is continually accelerated *(continue velocitatur)*. For from the beginning only the gravity was moving it. Therefore, it moved more slowly, but in moving it impressed in the heavy body an impetus. This impetus now [acting] together with its gravity moves it. Therefore, the motion becomes faster; and by the amount it is faster, so

* The italics here and elsewhere are, of course, mine.

the impetus becomes more intense. Therefore, the movement evidently becomes continually faster.

[The impetus then also explains why] one who wishes to jump a long distance drops back a way in order to run faster, so that by running he might acquire an impetus which would carry him a longer distance in the jump. Whence the person so running and jumping does not feel the air moving him, but [rather] feels the air in front strongly resisting him.

Also, since the Bible does not state that appropriate intelligences move the celestial bodies, it could be said that it does not appear necessary to posit intelligences of this kind, because it would be answered that God, when He created the world, moved each of the celestial orbs as He pleased, and in moving them He impressed in them impetuses which moved them without his having to move them any more except by the method of general influence whereby he concurs as a co-agent in all things which take place; "for thus on the seventh day He rested from all work which He had executed by committing to others the actions and the passions in turn." And these impetuses which He impressed in the celestial bodies were not decreased nor corrupted afterwards, because there was no inclination of the celestial bodies for other movements. Nor was there resistance which would be corruptive or repressive of that impetus. But this I do not say assertively, but [rather tentatively] so that I might seek from the theological masters what they might teach me in these matters as to how these things take place....

7. The first [conclusion] is that that impetus is not the very local motion in which the projectile is moved, because that impetus moves the projectile and the mover produces motion. Therefore, the impetus produces that motion, and the same thing cannot produce itself. Therefore, etc.

Also since every motion arises from a motor being present and existing simultaneously with that which is moved, if the impetus were the motion, it would be necessary to assign some other motor from which that motion would arise. And the principal difficulty would return. Hence there would be no gain in positing such an impetus. But others cavil when they say that the prior part of the motion which produces the projection produces another part of the motion which is related successively and that produces another part and so on up to the cessation of the whole movement. But this is not probable, because the "producing something" ought to exist when the something is made, but the prior part of the motion does not exist when the posterior part exists, as was elsewhere stated. Hence, neither does the prior exist when the posterior is made. This consequence is

obvious from this reasoning. For it was said elsewhere that motion is nothing else than "the very being produced" *(ipsum fieri)* and the "very being corrupted" *(ipsum corumpi)*. Hence motion does not result when it *has been* produced *(factus est)* but when it *is being* produced *(fit)*.

8. The second conclusion is that that impetus is not a purely successive thing *(res)*, because motion is just such a thing and the definition of motion [as a successive thing] is fitting to it, as was stated elsewhere. And now it has just been affirmed that that impetus is not the local motion.

Also, since a purely successive thing is continually corrupted and produced, it continually demands a producer. But there cannot be assigned a producer of that impetus which would continue to be simultaneous with it.

9. The third conclusion is that that impetus is a thing of permanent nature *(res nature permanentis)*, distinct from the local motion in which the projectile is moved. This is evident from the two aforesaid conclusions and from the preceding [statements]. And it is probable *(verisimile)* that that impetus is a quality naturally present and predisposed for moving a body in which it is impressed, just as it is said that a quality impressed in iron by a magnet moves the iron to the magnet. And it also is probable that just as that quality (the impetus) is impressed in the moving body along with the motion by the motor; so with the motion it is remitted, corrupted, or impeded by resistance or a contrary inclination.

10. And in the same way that a luminant generating light generates light reflexively because of an obstacle, so that impetus because of an obstacle acts reflexively. It is true, however, that other causes aptly concur with that impetus for greater or longer reflection. For example, the ball which we bounce with the palm in falling to earth is reflected higher than a stone, although the stone falls more swiftly and more impetuously *(impetuosius)* to the earth. This is because many things are curvable or intracompressible by violence which are innately disposed to return swiftly and by themselves to their correct position or to the disposition natural to them. In thus returning, they can impetuously push or draw something conjunct to them, as is evident in the case of the bow *(arcus)*. Hence in this way the ball thrown to the hard ground is compressed into itself by the impetus of its motion; and immediately after striking, it returns swiftly to its sphericity by elevating itself upwards. From this elevation it acquires to itself an impetus which moves it upward a long distance.

Also, it is this way with a cither cord which, put under strong tension and percussion, remains a long time in a certain vibration *(tremulatio)*

from which its sound continues a notable time. And this takes place as follows: As a result of striking [the chord] swiftly, it is bent violently in one direction, and so it returns swiftly toward its normal straight position. But on account of the impetus, it crosses beyond the normal straight position in the contrary direction and then again returns. It does this many times. For a similar reason a bell *(campana)*, after the ringer ceases to draw [the chord], is moved a long time, first in one direction, now in another. And it cannot be easily and quickly brought to rest.

This, then, is the exposition of the question. I would be delighted if someone would discover a more probable way of answering it. And this is the end.

COMMENTARY

The reader's attention is first called to the refutation in passages 2 and 3 of the two theories presented by Aristotle. The first point worth noting is that it is largely on the basis of experience that these two theories are shown to be inadequate. The *experientie* adduced against *antiperistasis*, i.e., the mechanical action of the air, are the following: (1) The spinning of a top or smith's wheel takes place without leaving its place of motion and the air can hardly be said to come behind the moving body to continue its motion. (2) The sharpening to a point of the posterior end of a lance does not thereby reduce its speed, as one would expect if this theory were correct. (3) In the course of the continuation of the movement of a ship in a river after the haulers have stopped pulling it, a sailor on deck does not feel the air pushing him from behind but rather feels it resisting him. Nor if behind some cargo would he be pushed against it; and similarly straws in the rear are not bent over. Similar "experiences" are brought against the second theory which held for a successive communication of motive power to the parts of the air.

In passage 4 Buridan states his acceptance of the theory which posited that the projectile motion is continued because the motor impresses in the projectile an *impetus* or motive force. He relates the intensity of impressed impetus to the velocity imparted by the original force to the projectile, i.e., the greater the velocity, the greater the impetus. Quite evidently this velocity is the speed of the projectile immediately after the original force of action has ceased. At the same time, he says that the impetus is made to decrease (i.e., is remitted and corrupted) in the same way that the motion is made to decrease, by the resistance and contrary inclination of the moving body. Perhaps Buridan might hold that the factors of impetus,

Document 9.1

John Buridan, *Questions on the Four Books on the Heavens and the World of Aristotle**

1. BOOK II, QUESTION 12. Whether natural motion ought to be swifter in the end than the beginning .... With respect to this question it ought to be said that it is a conclusion not to be doubted factually *(quia est)*, for, as it has been said, all people perceive that the motion of a heavy body downward is continually accelerated *(magis ac magis velocitatur)*, it having been posited that it falls through a uniform medium. For everybody perceives that by the amount that a stone descends over a greater distance and falls on a man, by that amount does it more seriously injure him.

2. But the great difficulty *(dubitatio)* in this question is why this [acceleration] is so. Concerning this matter there have been many different opinions. The Commentator (Averroës) in the second book [of his commentary on the *De caelo*] ventures some obscure statements on it, declaring that a heavy body approaching the end is moved more swiftly because of a great desire for the end and because of the heating action *(calefactionem)* of its motion. From these statements two opinions have sprouted.

3. The first opinion was that motion produces heat, as it is said in the second book of this [work, the *De caelo*], and, therefore, a heavy body descending swiftly through the air makes that air hot, and consequently it (the air) becomes rarefied. The air, thus rarefied, is more easily divisible and less resistant. Now, if the resistance is diminished, it is reasonable that the movement becomes swifter.

But this argument is insufficient. In the first place, because the air in the summer is noticeably hotter than in the winter, and yet the same stone falling an equal distance in the summer and in the winter is not moved with appreciably greater speed in the summer than in the winter; nor does it strike harder. Furthermore, the air does not become hot through move-

* Translated from the Latin edition of E. A. Moody, (Cambridge, Mass., 1942), pp. 176–81.

ment unless it is previously moved and divided. Therefore, since the air resists before there has been movement or division, the resistance is not diminished by its heating. Furthermore, a man moves his hand just as swiftly as a stone falls toward the beginning of its movement. This is apparent, because striking another person hurts him more than the falling stone, even if the stone is harder. And yet a man so moving his hand does not heat the air sensibly, since he would perceive that heating. Therefore, in the same way the stone, at least from the beginning of the case, does not thus sensibly heat the air to the extent that it ought to produce so manifest an acceleration *(velocitatio)* as is apparent at the end of the movement.

4. The other opinion which originated from the statements of the Commentator is this: Place is related to the thing placed as a final cause, as Aristotle implies and the Commentator explains in the fourth book of the *Physics*. And some say, in addition to this, that place is the cause moving the heavy body by a method of attraction, just as a magnet attracts iron. By whichever of these methods it takes place, it seems reasonable that the heavy body is moved more swiftly by the same amount that it is nearer to its natural place. This is because, if place is the moving cause, then it can move that body more strongly when the body is nearer to it, for an agent acts more strongly on something near to it than on something far away from it. And if place were nothing but the final cause which the heavy body seeks naturally and for the attainment of which the body is moved, then it seems reasonable that that natural appetite *(appetitus)* for that end is increased more from it as that end is nearer. And so it seems in every way reasonable that a heavy body is moved more swiftly by the amount that it is nearer to [its] downward place. But in descending continually it ought to be moved more and more swiftly.

But this opinion cannot stand up. In the first place, it is against Aristotle and against the Commentator in the first book of the *De caelo*, where they assert that, if there were several worlds, the earth of the other world would be moved to the middle of this world . . . .

Furthermore, this opinion is against manifest experience, for you can lift the same stone near the earth just as easily as you can in a high place if that stone were there, for example, at the top of a tower. This would not be so if it had a stronger inclination toward the downward place when it was low than when it was high. It is responded that actually there is a greater inclination when the stone is low than when it is high, but it is not great enough for the senses to perceive. This response is not valid, because if that stone falls continually from the top of the tower to the

earth, a double or triple velocity and a double or triple injury would be sensed near the earth than would be sensed higher up near the beginning of the movement. Hence, there is a double or triple cause of the velocity. And so it follows that that inclination which you posit not to be sensible or notable is not the cause of such an increase of velocity.

Again, let a stone begin to fall from a high place to the earth and another similar stone begin to fall from a low place to the earth. Then these stones, when they should be at a distance of one foot from the earth, ought to be moved equally fast and one ought not be swifter than the other if the greater velocity should arise only from nearness to [their] natural place, because they should be equally near to [their] natural place. Yet it is manifest to the senses that the body which should fall from the high point would be moved much more quickly than that which should fall from the low point, and it would kill a man while the other stone [falling from the low point] would not hurt him.

Again, if a stone falls from an exceedingly high place through a space of ten feet and then encountering there an obstacle comes to rest, and if a similar stone descends from a low point to the earth, also through a distance of ten feet, neither of these movements will appear to be any swifter than the other, even though one is nearer to the natural place of earth than the other.

I conclude, therefore, that the accelerated natural movements of heavy and light bodies do not arise from greater proximity to [their] natural place, but from something else that is either near or far, but which is varied by reason of the length of the motion *(ratione longitudinis motus)*. Nor is the case of the magnet and the iron similar, because if the iron is nearer to the magnet, it immediately will begin to be moved more swiftly than if it were farther away. But such is not the case with a heavy body in relation to its natural place.

5. The third opinion was that the more the heavy body descends, by so much less is there air beneath it, and the less air then can resist less. And if the resistance is decreased and the moving gravity remains the same, it follows that the heavy body ought to be moved more swiftly.

But this opinion falls into the same inconsistency as the preceding one, because, as was said before, if two bodies similar throughout begin to fall, one from an exceedingly high place and the other from a low place such as a distance of ten feet from the earth, those bodies in the beginning of their motion are moved equally fast, notwithstanding the fact that one of them has a great deal of air beneath it and the other has only a little.

Hence, throughout, the greater velocity does not arise from greater proximity to the earth or because the body has less air beneath it, but from the fact that that moving body is moved from a longer distance and through a longer space.

Again, it is not true that the less air in the aforementioned case resists less. This is because, when a stone is near the earth, there is still just as much air laterally as if it were farther from the earth. Hence, it is just as difficult for the divided air to give way and flee laterally [near the earth] as it was when the stone was farther from the earth. And, in addition, it is equally difficult or more difficult, when the stone is nearer the earth, for the air underneath to give way in a straight line, because the earth, which is more resistant than the air, is in the way. Hence, the imagined solution *(imaginatio)* is not valid.

6. With the [foregoing] methods of solving this question set aside, there remains, it seems to me, one necessary solution *(imaginatio)*. It is my supposition that the natural gravity of this stone remains always the same and similar before the movement, after the movement, and during the movement. Hence the stone is found to be equally heavy after the movement as it was before it. I suppose also that the resistance which arises from the medium remains the same or is similar, since, as I have said, it does not appear to me that the air lower and near to the earth should be less resistant than the superior air. Rather the superior air perhaps ought to be less resistant because it is more subtle. Third, I suppose that if the moving body is the same, the total mover is the same, and the resistance also is the same or similar, the movement will remain equally swift, since the proportion of mover to moving body and to the resistance will remain [the same]. Then I add that in the movement downward of the heavy body the movement does not remain equally fast but continually becomes swifter.

From these [suppositions] it is concluded that another moving force *(movens)* concurs in that movement beyond the natural gravity which was moving [the body] from the beginning and which remains always the same. Then finally I say that this other mover is not the place which attracts the heavy body as the magnet does the iron; nor is it some force *(virtus)* existing in the place and arising either from the heavens or from something else, because it would immediately follow that the same heavy body would begin to be moved more swiftly from a low place than from a high one, and we experience the contrary of this conclusion . . . .

From these [reasons] it follows that one must imagine that a heavy body

not only acquires motion unto itself from its principal mover, i.e., its gravity, but that it also acquires unto itself a certain impetus with that motion. This impetus has the power of moving the heavy body in conjunction with the permanent natural gravity. And because that impetus is acquired in common with motion, hence the swifter the motion is, the greater and stronger the impetus is. So, therefore, from the beginning the heavy body is moved by its natural gravity only; hence it is moved slowly. Afterwards it is moved by that same gravity and by the impetus acquired at the same time; consequently, it is moved more swiftly. And because the movement becomes swifter, therefore the impetus also becomes greater and stronger, and thus the heavy body is moved by its natural gravity and by that greater impetus simultaneously, and so it will again be moved faster; and thus it will always and continually be accelerated to the end. And just as the impetus is acquired in common with motion, so it is decreased or becomes deficient in common with the decrease and deficiency of the motion.

And you have an experiment [to support this position]: If you cause a large and very heavy smith's mill [i.e., a wheel] to rotate and you then cease to move it, it will still move a while longer by this impetus it has acquired. Nay, you cannot immediately bring it to rest, but on account of the resistance from the gravity of the mill, the impetus would be continually diminished until the mill would cease to move. And if the mill would last forever without some diminution or alteration of it, and there were no resistance corrupting the impetus, perhaps the mill would be moved perpetually by that impetus.

7. And thus one could imagine that it is unnecessary to posit intelligences as the movers of celestial bodies since the Holy Scriptures do not inform us that intelligences must be posited. For it could be said that when God created the celestial spheres, He began to move each of them as He wished, and they are still moved by the impetus which He gave to them because, there being no resistance, the impetus is neither corrupted nor diminished.

You should note that some people have called that impetus "accidental gravity" and they do so aptly, because names are for felicity of expression. Whence this [name] appears to be harmonious with Aristotle and the Commentator in the first [book] of this [work, the *De caelo*], where they say that gravity would be infinite if a heavy body were moved infinitely, because by the amount that it is moved more, by that same amount is it moved more swiftly; and by the amount that it is moved more swiftly,

by that amount is the gravity greater. If this is true, therefore, it is necessary that a heavy body in moving acquires continually more gravity, and that gravity is not of the same constitution *(ratio)* or nature as the first natural gravity, because the first gravity remains always, even with the movement stopped, while the acquired gravity does not remain. All of these statements will appear more to be true and necessary when the violent movements of projectiles and other things are investigated . . . .

COMMENTARY

This selection (passages 3–5) tells us of three common explanations of the cause of the acceleration of falling bodies in addition to the fourth, the impetus explanation which Buridan is supporting: (1) a heating of the medium which decreases its resistance and thus increases the velocity; (2) proximity to natural place which acts by some virtue or other (like that of the magnet) as a moving cause, this virtue being increased as the body comes closer (see the discussion of Simplicius and Aristotle in the introductory remarks of this chapter); (3) as the body falls there is continually less air beneath it acting as resistance; hence the velocity increases (see the discussion of Simplicius above);[22] (4) the impetus explanation, i.e., gravity continually introduces an impetus which acting as a supplementary increasing cause of movement, and acting with the gravity, produces the acceleration. Among the other explanations not mentioned by Buridan were two which centered around the supplementary action of the medium: (5) one which held that air stirred up by the movement is able to get behind the falling body and give it supplementary pushes (a theory taken over from Aristotle's explanation of the continuance of projectile motion, see Chapter 8);[23] and (6) the falling body not only draws the air behind, but in pushing the air beneath it, it sets it in motion, and this air sets other air in motion, and the drawing action of the air makes it less resistant and helps the gravity of the body (a theory found in the *Liber*

[22] Something of this sort is understood by the author of the *De sex inconvenientibus* (see footnote 15 and cf. Maier, *An der Grenze*, pp. 190–91). A somewhat different view was held by Durandus de St. Porciano, who held that "by the amount that the air is closer to the earth, by that amount is it less light and exerts itself less against the motion of the heavy body" ("motus naturalis sit intensior in fine quam in principio: causa est minor resistentia medii, supposita eadem inclinatione mobilis, quanto enim aer est terrae propinquior, tanto est minus levis et minus nititur contra motum gravis"). *Sent.*, Bk. II, dist. 14, quest. 1, quoted through Maier, *An der Grenze*, p. 190.

[23] It is this theory that is referred to by "pulsus medii" by the author of the *De sex inconvenientibus*, *edit. cit.* in footnote 15.

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