

# Motion and Its Principles (part 2)

Regina Cœli Academy  
Natural Philosophy – Physics  
Lecturer: Mr. Alan Aversa


O Creator ineffable, who of the riches of Thy wisdom didst appoint three hierarchies of Angels and didst set them in wondrous order over the highest heavens, and who didst apportion the elements of the world most wisely: do Thou, who art in truth the fountain of light and wisdom, deign to shed upon the darkness of my understanding the rays of Thine infinite brightness, and remove far from me the twofold darkness in which I was born, namely, sin and ignorance. Do Thou, who givest speech to the tongues of little children, instruct my tongue and pour into my lips the grace of Thy benediction. Give me keenness of apprehension, capacity for remembering, method and ease in learning, insight in interpretation, and copious eloquence in speech. Instruct my beginning, direct my progress, and set Thy seal upon the finished work, Thou, who art true God and true Man, who livest and reignest world without end. Amen.

(St. Thomas Aquinas *Oratio ante studium*)

# Substance is a Nature Existing.

- 4 kinds of being that manifest motion:
  - Substance
    - e.g, chemical changes
  - Place
    - Locomotion
  - Quantity
    - Augmentation or diminution
      - e.g, when a plant grows larger or smaller
  - Quality
    - e.g, the sonic properties of liquid versus solid water

# Substance is a Nature Existing.

- 6 species of motion (review):
  - Generation  Substantial Changes
  - Destruction (corruption)
  - Local movement
  - Augmentation
  - Diminution
  - Alteration

# Substance is a Nature Existing.

- What is substance?
  - Not considered *qua* being as in metaphysics
  - Philosophical physics treats substance as that in which accidents adhere.
    - E.g., the element iron – with its accidents of density, color, electrical conductivity, specific heat, magnetic properties, etc. – is a substance.
- Substance is what a being is.
- An accident is what a substance has.
  - Accidents are called *ens entis*.

# Substance is a Nature Existing.

- What is substance's relation to nature?
  - Is substance nature?
- Distinction:
  - Nature = “second substance”
    - “a universal community of a given kind”
  - Substance proper = “first substance”
    - “individually existent thing within the kind”
- We understand substances by their accidents.

# Substance is a Nature Existing.

- Do substantial changes exist?
  - Experience says: “Yes!”
    - E.g., hydrogen and oxygen gases combine to form a liquid that is neither hydrogen nor oxygen but water.
- Substantial versus accidental changes. Identify:
  - Apple growing on a tree, changing from green to red
  - Apple eaten and digested by a man
- Empiriological physics, because it deals only with quantity and locomotion, does not treat substantial change.

# Substantial Changes Involve Prime Matter.

- Form and matter of substantial changes:
  - Substantial form
  - Prime matter
    - Differs from “second matter” in that it is *pure* potency
- Why do we need prime matter?
  - ∴ something cannot come from nothing
  - Change must have a subject.
  - Substantial change is not annihilation followed by creation.



# Substantial Changes Involve Prime Matter.

- Aristotle's definition of prime matter:
  - Positively: "the primary substratum of each thing from which it comes to be without qualification, and which persists in the result."
  - Negatively: "that which in itself is neither a particular thing nor of a certain quantity nor assigned to any other of the categories by which being is determined."
- Prime matter is not nothing; it is *pure potency*.
- It "is the fundamental changeless element in change."

# Substantial Changes Involve Substantial Form.

- Form is prime matter's first act.
- Erroneous explanations of novelty in the world:
  - St. Augustine thought that forms were pre-contained in matter in a “seminal existence” (*rationes seminales*).
    - This view argues against a substantial unity of composite being.
      - Viz., substance is not an aggregate.
  - Scientism
    - Harkens to Descartes's mechanism
    - Substantial change is just a rearrangement of particles.

# Substantial Changes Involve Substantial Form.

- *Eduction*: Form of new substance *educed* from prime matter
- Old form returns to the potency of prime matter.
  - Prime matter (PM) + form (F) 1 → PM → PM + F2
- Form and matter immediately united
  - Suarez thought the union of matter and form occurred through a medium.
    - PM + medium (M+F) + F1 → PM + medium (M+F) → PM + medium (M+F) + F2
    - This denies intrinsic unity of substances.

# Substantial Changes Involve Substantial Form.

- Problem of the plurality of forms
  - Debated by Abelard and William of Champeaux in 12<sup>th</sup> century until Ockham
  - St. Thomas opposed it.
    - His contemporaries Bonaventure, Alexander of Hales, and St. Albert the Great supported it.
- But how would unity of substances be achieved?
- Forms are not generated or corrupted.

# Substantial Changes Involve Substantial Form.

- Substantial motion is, strictly speaking, not motion. It is a change (*mutatio*).
- There is no gradation between being and non-being.
- Substantial form is in every part and the whole of a substance.
  - E.g., the substantial form of a human
    - The intellectual soul
  - E.g., the substantial form of an iron atom

# Substantial Changes Prove Matter-Form Dualism

- The dialectical proofs:
  - “Material substances reflect unity and multiplicity.”
  - “Material substances display both passivity and activity, and there must be a corresponding principle for each.”
  - “Time and space are often differentiated.”
    - Time reflects dynamism (form). Space is like matter.
  - “There is a determination (form) and an indetermination (matter) in everything.”
  - “There is a principle of limit (matter) and of limitlessness (form) in corporeal reality.”

# Atomism and Mechanism are Inertialisms

- Modern attempts to explain change without matter/form dualism:
  - Mechanism (atomism)
    - Dates back to pre-Socratics like Anaxagoras, Anaxamander, Empedocles, Democritus, and Epicurus
    - “[A] thing is viewed as a machine without intrinsic unity and with all its principles, art-like, outside of it.”
  - Dynamism
    - Greek *dyn-* = force or energy.
    - Everything comprised of energy or forces

# Atomism and Mechanism are Inertialisms

- Mechanism in Cartesian philosophy:
  - Body = extension.
  - Change = local movement.
- Advances in empiriological chemistry and physics seem to support atomism:
  - e.g, Max Planck's early 20<sup>th</sup> century discovery that energy is quantized (discrete)
  - Splitting the atom



# Atomism and Mechanism are Inertialisms

- Hylosystemism = “mechanism dressed in scholastic terminology”
  - “Hylosystemists want philosophy to pitch its camp on empiriological terrain”.
  - Hylosystemists deny that:
    - Philosophy of nature is concerned primarily with motion, not with the constitution of bodies.
    - Philosophy of nature studies change.
  - Hylosystemists’ dogma: matter is art, not nature

# Dynamism Reduces Matter to the Immaterial

- Heraclitus a great ancient dynamist.
- Leibnitz's monadology
  - Monads = inextended, quasi-alive substances
- Fr. Boscovich, S.J., "held that matter is composed of indivisible points".
- Einstein held matter *is* energy ( $E=mc^2$ ).
- Quantum mechanics
  - Energy in discrete *quanta* ("bits") comprises everything.

# Mechanism and Dynamism are Inadequate

- Both mechanism and dynamism deny substantial changes.
  - Mechanism cannot explain novelty.
    - It explains “the persistency factor in change”.
  - Dynamism cannot explain “the persistency factor”
    - It does explain novelty.

# References

- V. E. Smith's *Philosophical Physics*
  - Please finish reading ch. 2 (Motion and Its Principles).
    - We will send out a scanned PDF of this required reading.
- Aristotle, *Physics*, Bks. I, II.
- Aristotle, *Metaphysics*, Bks VII, VIII.