

Motion, Dualism, and Modern Physics (part 3)

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Natural Philosophy – Physics
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Grant me the grace, O merciful God, to desire ardently all that is pleasing to Thee, to examine it prudently, to acknowledge it truthfully, and to accomplish it perfectly, for the praise and glory of Thy name. Amen.

Prayer of St. Thomas which he was accustomed to recite everyday before the image of Jesus Christ.



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The Law of Entropy Attests to Natures

- Entropy “is the measure of the unavailability of [...] thermal energy for conversion into mechanical work” (*OED*).
 - Disorder
- 2nd Law of Thermodynamics implies:
 - Nature is instable.
 - There will be a “heath death” of the universe.
 - Energy cannot be transmuted from one form to another indefinitely.

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The Law of Entropy Attests to Natures

- Atoms less inert, “more stable, more conservative,” more “capable of acting” than subatomic particles
 - Recall: “Inert” means “[h]aving no inherent power of action, motion, or resistance; inactive, inanimate; having the property of inertia.” (*OED*).
 - “Conservative” means here: “able to maintain its being.”
- Atoms have more being and nature.
- Their stability doesn’t result from subatomic particles’ instability
 - ∴ instability + instability ≠ stability.

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The Law of Entropy Attests to Natures

- Bergson claimed that the 2nd Law is “the most metaphysical of empirical laws.”
 - Why? ∴ 2nd Law determines directionality of time
- Why is the universe’s “heat death” not infinitely fast? If there are no “braking principles,” wouldn’t it be?
- Empedocles’s cosmology: law of love and law of hate
 - This is like the 1st and 2nd Laws.

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Thermodynamics Confirms Matter and Form

- (1) Only can a “nature existing” (a substance) that is a unity of matter and form be both conservative and entropic.
 - “Entropic” means “with allusion to the randomness, uniformity, and unavailability of energy for work that entropy measures.” (*OED*).
 - The empiriological physicist would reduce one reality (conservation), which obeys the 1st Law, and another unrelated reality (entropy), which obeys the 2nd Law, to two distinct principles; but conservation and entropy are ultimately rooted in one subject.

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Thermodynamics Confirms Matter and Form

- (2) Matter-form dualism explains the bifurcated nature of the atom:
 - Matter is the “divisive and destructive” principle.
 - Form is the “unitive,” “conservative principle.”
- Heisenberg’s uncertainty principle: $\Delta x \Delta p \geq \hbar/2$
 - Cannot measure position x or momentum p simultaneously to arbitrary precision.
 - If x or p were exactly known, the other would be completely unknown.
 - Matter → position; form → velocity

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Thermodynamics Confirms Matter and Form

- Uncertainty principle
 - Error in position and velocity more important on the micro- than the macro-scale.
 - Objects on micro-scale have less nature, are more inert.
- Matter-form dualism ⇒ position and velocity immediately united.
- Is the uncertainty principle due, however, to a lack in our understanding of the physics?
 - In other words: Is it an epistemological issue?

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Thermodynamics Confirms Matter and Form

- Aquinas: Knowability of something follows its immateriality, but atoms are grossly inert.
- Can you smell, taste, touch, hear, feel atoms?
- Einstein’s general relativity (GR) theory of gravity also shows there must be a dualism in substances (natures existing).
 - Space-time continuum must be isotropic, yet for it to be heterogeneous, it must be discontinuous.
 - GR’s fundamental equation contains symmetrical and anti-symmetrical parts.

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Thermodynamics Confirms Matter and Form

- Pre-Aristoteleans cosmologists’ dualisms:
 - Pythagoras: odd and even
 - Plato: great and small
 - Anaximander: condensation and rarefaction
- Aquinas thought that
 - they all were “groping in the dark” for Aristotle’s formulation of hylemorphism (matter-form dualism) and that
 - even false philosophies can catch a glimpse of truth “from the light of being.”

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Objections to Matter-Form are Inadequate

- “If the planetary model of the atom is denied as being a mechanical aggregate, why not make the same statement about the solar system?” Or what about a house? How is a house any different than an atom?
- Whitehead’s standard for finding differences between two natures: Look at how the two operate under the same external conditions.
- Natures come from within, so “Don’t judge a nature by its appearances, by what’s ‘without!’”
- Natures are not due to a “mechanical linkage of their component elements,” as mechanism holds.

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That $E = m c^2$ Does not Refute Matter-Form

- E is the measure of energy, m is the measure of mass, and c is the measure of the speed of light.
- Does this mean energy and matter themselves are equivalent?
- In 1939 Hahn and Strassmann bombarded uranium with neutrons to produce lighter elements like barium.
 - The resultant particles were less massive than the original uranium atom.

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That $E = m c^2$ Does not Refute Matter-Form

- Why is there a difference in mass?
 - Had matter been annihilated?
 - Was the mass difference changed into energy?
 - Has matter changed into a property of matter?
 - Can something extended be reduced to something unextended?
- Solution: “binding energy”
- A mass on a mountaintop has less weight than a mass at sea-level. Has it lost mass by going from sea-level to a mountaintop?

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That $E = m c^2$ Does not Refute Matter-Form

- Mass is measured by energy.
 - A scale determines the mass of a person based not on mass directly but on how much energy he exerts in overcoming the tension of the spring inside the scale.
 - Inertia measured by using energy to exert a force.
- Energy is measured by mass.
 - A foot-pound is a unit of energy.
 - It's the amount of energy required to raise an object 1 ft.
- Mass / energy dichotomy artificial

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That $E = m c^2$ Does not Refute Matter-Form

- Isn't it a vicious circle to define energy in terms of mass and mass in terms of energy?
- Empirical physics cannot make the distinction; philosophy needed
- Einstein's equation really about conversion of energy into different forms.
- If mass is substance and energy is an accident, then a change in energy should change extension? Doesn't this refute hylemorphism?
 - The fission fragments *are* less extended.

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That $E = m c^2$ Does not Refute Matter-Form

- Uranium fission does not fit into these two conceptions:
 - Galileo, Newton: substances defined by mass and weight
 - Descartes: substances defined by quantity
- Aquinas, instead, defines a natural body “in terms of its mobility and the dualism of principle which motion discloses.”
- Philosophical physics: so-called mass needn't be constant; only prime matter constant

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That $E = m c^2$ Does not Refute Matter-Form

- Binding energy concept illustrates hylemorphism.
 - Are atoms just an aggregate of subatomic particles, as a mechanist would say?
 - Subatomic particles do undergo a substantial change when they combine to form an atom; ∴, hylemorphism holds for atoms.
- But what *are* matter and energy?
 - Empirical physicist: 2 ways of looking at 1 thing
 - Philosophical physicist: mass and energy irrelevant
 - He speaks of substantial form and prime matter, or accidental form and second matter.

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References

- V. E. Smith's *Philosophical Physics*
 - Please finish reading ch. 6 (Motion, Dualism, and Physics).
 - I will post PDF of the reading on the reginacoeli.box.com page.

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