Progress and Purpose

Regina Cœli Academy
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.

Finality Organizes Motion

- Order in nature ⇔ final causality
- Efficient causes need a final cause.
  - Without final causality one resorts to explaining order with chance.
- Lecture outline:
  - Progressive character of the universe
    - "[F]inality explains progress without divinizing it."
  - Tendencies that deny progress
    - Modern views of chance
  - Defense of the realism of progress and purpose

Finality Makes for Progress

- "Does progress imply that there is more to the effect than to the cause?"
  - Viz., does the greater or more come from the less?
    - It seems so ∵ motion starts with potency and ends in act.
- Answer: "This higher rung which things naturally attain from a lower one can be clarified by final causality."
  - "The efficient cause cannot wholly explain progress."
- Aquinas: Final causes is "cause of causes."

God is the Goal of Nature's Motions

- Some contemporary systems: God is not the goal of nature's motions, but its final product.
  - Whitehead: "God, in his 'consequent nature,' is the product" of cosmic motion.
  - Alexander: God is a "nisus" (impulse, tendency).
  - Hartshorne: God, "the self-surpassing surpasser of all," is effected by the world's processes.
- Yet God cannot make nature fashion Himself; ∴, God is the cosmos's final cause.
- Just as Motor causality ⇒ Prime Mover, so, too, does Final causality ⇒ Supreme Designer.

Modern Premises Conclude to Chance World

- No finality ⇒ no progress, no motion
- Modern mind says: "Universe governed by chance alone."
  - To explain physical bodies, Descartes's physics looks inside bodies only and neglects final causes.
    - Chance, spontaneity, indeterminism, and atomism
- Empiriological physics cannot grasp tendencies toward ends
  - Inertia ⇒ lack of tendencies.
  - Method of control (experimentation) does not allow tendencies to manifest themselves.

Inertialism Suggests Chance

- Inertialism ⇒ chance universe ∵ an ∞ series of inertial movers could never generate motion.
- Chance is a "rare deviation," not an absolute disorder.
  - Chances comes from outside the nature which it affects.
- "It would have to stand without a relation, or rather with all its relations outside. But, since a thing must be determined by the relations in which it stands, the absolutely contingent would thus be utterly determined from the outside. And so, by consequence, chance would involve complete internal dissipation."

—Bradley, *Appearance and Reality*

- "[W]hatever is 'utterly determined from the outside' would be 'absolutely contingent.'"

Inertialism Suggests Chance

- A cause of chance is not unified, but plural; so, pluralism ⇒ chance universe.
- Chance is extrinsic to a natural agent.
- Aristotle's term for a chance event: *αὐτόματον* (automaton), root of English word "automatic"
  - Literally, "by nature vain"
  - An automaton is a machine.
    - Mechanistic conception of nature ⇒ chance.
- Chance is spontaneous, self-moved, beyond nature, automatic.

Empiriological Physics Emphasizes the Statistical

- Laplace, Bernoulli, Boltzmann, Maxwell: Statistical approach to thermodynamics
- What is statistics?
  - Statistics is "a way of measuring large quantities of individuals which single measurements would make too complicated."
  - Infer from a small sample the properties of a whole population
    - e.g., from a small opinion poll one could infer what a whole population thinks about a certain issue.

Empiriological Physics Emphasizes the Statistical

- Statistics is "a movement from the part to the whole" (induction).
  - Coin toss example:
    - "Part" would be an individual flip of the coin
      - heads or tails
    - "Whole" would be an ensemble of flips
      - e.g., 10,000 throws
- Going from whole to part (deduction) not accurate
  - Coin toss example again (10,000 flips ⇒ ~5,000 heads and ~5,000 tails):
    - This does not tell us the result of an individual toss.

Empiriological Physics Emphasizes the Statistical

- Deductive statistics in empiriological physics
  - Gas in chamber example:
    - Physicists can deduce, from the pressure exerted on the walls of the chamber, the average energy of each molecule in the gas.
- Empiriological physics applies statistics:
  - Average velocity of particles in a gas
  - Average distance a gas particle travels before colliding (mean free path)
  - Number of particles hitting chamber wall per second
  - Radioactive decay: half-life
    - Statistics does not say which atoms of a radioactive sample will decay.
- The empiriological physicist "cannot forecast the fate of individuals."

Quantum Mechanics Tends to Indeterminism

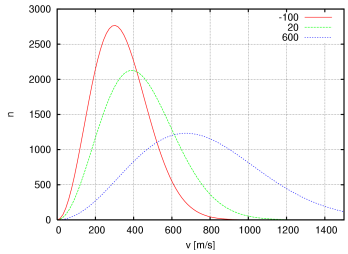
- Classical physics used statistics due to a lack of knowledge of particulars.
  - e.g., of specific molecules in a gas
- Quantum mechanics and Heisenberg's Uncertainty Principle ⇒ nature indeterminate
  - Quantum mechanics is a probabilistic theory.
- Max Planck discovered energy comes in discrete packets called *quanta.*
- Schrödinger devised the *wave-function*, a sort of "probability wave" that represents particle-waves.

Thermodynamics is Allegedly Indeterministic

- Law of entropy deterministic on macroscopic level
- On the microscopic level, empiriological physics says there are random events.
- Example: If it's probable for one electron in an electric current in a wire to travel the opposite way, is it possible for them all to travel "counter-current," so that the current is now flowing in the opposite sense?

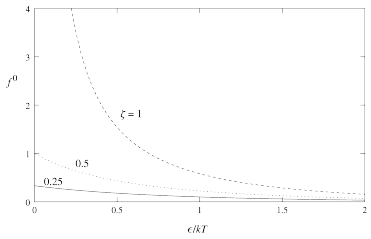
Thermodynamics is Allegedly Indeterministic

- Boltzmann statistics
  - Classical
  - "assumes that all particles in a collection have average values and that the value of the whole is equal to their sum"
  - $E_{average} = E_{total} / N$, where the Es are energies and N is the total number of gas particles



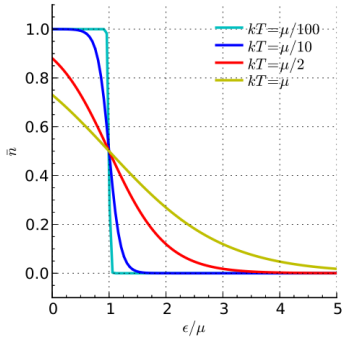
Thermodynamics is Allegedly Indeterministic

- Bose-Einstein statistics
  - Quantum mechanical
  - "[E]ach particle can occupy all the positions in a given volume with equal likelihood."
  - All particles have same energy
  - Applies to photons and nuclei of atoms with an even number of particles
    - Called *bosons*



Thermodynamics is Allegedly Indeterministic

- Fermi-Dirac statistics
  - Quantum mechanical
  - "assumes all particles occupy different positions"
  - Particles' energies are all different.
  - Applies to protons, neutrons, electrons, and nuclei of atoms with an odd number of particles
    - called *fermions*



Thermodynamics is Allegedly Indeterministic

- All three statistical distributions postulate randomness.
  - Boltmann: Random distribution of parts
  - Bose-Einstein: Random distribution of wholes
  - Fermi-Dirac: Equal repartition of differences
- Why don't we see randomness at macroscopic scales, then?
  - Odds are very small that this would happen

Thermodynamics is Allegedly Indeterministic

- What are the odds all the gas in your room would suddenly travel in one direction toward just one wall?
  - Empiriological physicist admits this possibility, but with a very small probability.
- Statistical physics says heat *is* the random movement of particles.
  - The more heat, the more evenly distributed are these motions.
- Desk randomly floating into air or water on heated stove freezing? This is possible, but very improbable!
- There is no heat in a single atom.

References

- V. E. Smith's *Philosophical Physics*
  - Please begin reading the first half of ch. 8 (Progress and Purpose).
    - I will post PDF of the reading on the reginacoeli.box.com page.