

## The Newtonian Worldview

An Outline and Some Criticisms

## Basic Pieces of the Newtonian Worldview

- Law-based
- Reductionist
- Materialist/Atomist
- Dualist
- Deterministic

## The Idea of Natural Laws

- Newtonian mechanics envisioned a Universe governed by immutable natural laws rather than by the whim of God or supernatural entities.
- These laws apply equally to all objects in all situations (democratic).
- However, we have seen that some laws are statistical in nature (2nd law of Thermodynamics)

## Reductionism

- Reductionism assumes that all properties of a system are explainable by explaining the individual behavior of its smallest constituents.
- But there are “emergent” phenomena that come about only when there are a large number of mutually interacting objects/particles.

## Atomic Materialism

- The Newtonian worldview assumes that *everything* is composed of atoms, and these atoms serve as the smallest constituents of any physical system in the process of reductionism.
- What about electric and magnetic fields? Are these composed of atoms?

## Dualism

- The Newtonian worldview considers the physical and spiritual realms to be entirely separate. This way physics can avoid conflicting with religion.
- How, then, can your *spirit* direct out *body*? How could God (spiritual) create or interact with the Universe (physical)?

## Determinism

- Since everything is made of atoms, the behavior of any system can be predicted perfectly if you know the initial position and velocity of all of its atoms and know how atoms interact.
- Chaos makes this impractical, but it is still possible in principle.

## The Clockwork Universe

- The Newtonian worldview centers on the idea of *mechanism*, such as the gears and springs that run a clock.
- The idea is that the Universe is like a giant clock that was assembled and wound up by God, but no longer needs anything else to keep functioning according to its rules of operation.

## Extensions of Newtonian Mechanics

- Energy
- Thermal physics (heat, entropy, etc.)
- Electric and magnetic fields
- New versions of Newton's Laws
  - Lagrangian Mechanics - the Principle of Least Action
  - Hamiltonian Mechanics
  - Etc.

## One Thing Leads to Another

- The development of some new concepts may be dependent on some other concepts.
- For example, physicists might not have been convinced of the reality of electric and magnetic fields if they did not know about energy and momentum.

## Influence of Technology

- As mentioned above, the Newtonian worldview as influenced by clocks.
- Nineteenth Century physics (and philosophy) was influenced by the Industrial Revolution and the steam engine.
- Current thinking is highly influenced by computers and digital devices.

## Limitations of Newtonian Physics

- Newtonian physics has limited scope.
- Very fast objects (speeds comparable to the speed of light): Special Relativity.
- Very massive or large objects (stars, galaxies, the Universe): General Relativity
- Small things (atoms, electrons): Quantum Mechanics

### Has Newtonian Mechanics Been Falsified?

- In a way, yes.
- So why do we still use it?
- Because it works exceedingly well in a wide variety of situations and the replacement theories are more difficult to use in those situations.
- So Newtonian physics has been supplemented but not really replaced.

### Influence of Newtonian Worldview

- Newtonian thinking has had a profound influence on society: the concept of natural law inspired democracy, but the mechanistic and deterministic view of nature also inspired communism.
- Dualism has had a profound impact on the way we see ourselves in relation to nature.
- Etc.