Astronomy 350L
(Spring 2005)

The History and Philosophy of Astronomy

(Lecture 12: Descartes)

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Rene Descartes: The First Modern Philosopher

- **1596 (La Haye) – 1650 (Stockholm)**

- founder of modern philosophy
  - method of radical doubt
  - mind-body dualism

- invented analytical geometry (Cartesian coordinates)

- Importance for astronomy:
  - mechanistic universe
  - infinite universe
Descartes: Timeline and Context

- setting the intellectual stage for Newton
- younger contemporary of Galileo and Kepler
Descartes: Geography of his Life
School in La Fleche (1606-14)

• newly established elite school, run by Jesuits
• Curriculum:
  - Latin
  - scholastic philosophy
  - state-of-the-art mathematics
A Restless Early Life

- 1615-16: University in Poitiers (law degree)
- 1618: joins Dutch army (as engineer)
- 1619: joins Bavarian army (30 Years War)
- 1622-28: lives in Paris
- Also: extensive travel throughout this period
Descartes in Paris (1622-28)

• Paris: the hotspot of the Age!
Descartes in Paris: Centralization of Power

- Cardinal Richelieu (1585-1642)
  - rise in power
  - becomes Chief Minister
  - creates centralized (abolutistic) French State
  - founds Academie Francaise ("guardian" of French language)
Descartes: A Desire for Calm and Peace

- after having seen the world, Descartes wants quiet time to think and write
- decides to leave bustle of Paris behind
- move to Netherlands (sedentary 2nd half of his life)
Descartes in the Netherlands (1628-49)

- A young, vibrant nation: most tolerant place in Europe then!
Descartes in the Netherlands (1628-49)

- A superpower of the 17th century!
The Dutch Golden Age (Arts and Sciences)

The Night Watch, Rembrandt (1606-69)
The Philosopher: A New System

- **Discours de la Methode**
  (Discourse on the Method, 1637)

- Radical doubt:
  - nothing is certain, but:
  - Cogito, ergo sum
    (I think, therefore I am)

- Dualistic philosophy (mind-body)

- First truly original philosophical system since antiquity
The Philosopher: Radical Doubt

- Destruction of all previous certainties
- I cannot be sure of what my senses tell me (after all, I could be dreaming…)
- But: I cannot doubt *one* thing: That *I* doubt (think)!
- Thus: My thinking proves my existence!

I think, therefore I am!
The Philosopher: Prove God’s Existence

- I know that I am not perfect, but I have the idea of a perfect being in my mind!

- This perfect being cannot be the same as me, as I myself am surely imperfect!

- This perfect being would not be perfect if it did not also exist!

The perfect being (God) exists!
Prove Existence of Outside Objects

• In my thinking, I clearly conceive of objects in the outside world!

• God, being perfect, would not deceive me!

The outside world exists!

• But this outside world is very different from the thinking mind!
• There are two kinds of substance!
Cartesian Dualism

- **Mind**
  - thinks
  - free thought/will

- **Bodies**
  - has “extension” (length, breadth, width)
  - behave according to laws of physics (determinism)

- Two realms of reality are fundamentally different and independent!
Cartesian Dualism

• The human body is a machine

• But the brain then is also part of this machine

• Big Q: How does the mind interact with the brain?
Mind and body only appear to interact, but are really pre-set in parallelism!
What about free will? (Brain follows deterministic laws…)
The Mathematician: Analytical Geometry

- merge geometry and algebra!
- (Cartesian) Co-ordinates!
The Scientist: Matter in Motion

- *Principia Philosophiae* (Philosophical Principles, 1644)
- Theory of matter, space, and motion
- A mechanical system of the universe (matter in motion)
- An infinite universe
The Scientist: Space and Matter

• begin with empty (“undressed”) space of geometry!
• Direct collisions can change motion!
There can be no vacuum!

Assume for the moment that there were empty space!

But: Portion of empty space has “extension”!

Thus (according to Descartes): There must also be matter (whatever has extension is matter, and vice versa!)
• space is densely packed with material particles!
• No gaps between!  World is a *plenum*!
Motion in Completely Filled Space

- particle experiences pushes from adjacent particles!
- path is bent into closed (≈circular) shape!
Descartes Model of the Universe

- vortex (whirlpool) cosmology!
- space/matter have no edge!
- infinity of vortices
  - infinitude of Suns and Solar systems
- The universe has no center and no edge!
- Red path: Descartes’ (wrong) theory for comets!
The Clockwork Universe

• Descartes establishes picture of universe governed by simple laws of motion (the “mechanical philosophy”)

• Many of detailed explanations were soon found to be wrong, but overall approach became highly influential (e.g., Newton)!
Toward the Infinite Universe: Thomas Digges

- popularizer of Copernican model (1576)!

- stars are *not* confined to a thin shell!
1663: Descartes on Index of Forbidden Books

- **Index Librorum Prohibitorum**
- Organized censorship
- Introduced in 1559
- Abolished in 1966
Journey’s end: Move to Stockholm

- Invitation from Queen Christina of Sweden
- Descartes as Queen’s private tutor
- Problem: Descartes has to show up at court already at 5am
Journey’s end: Death in Stockholm 1650

- contracts lethal pneumonia during fierce Swedish winter!
Descartes

• Rene Descartes:
  - founder of modern philosophy
  - a new system of philosophy
  - based on method of radical doubt (Cogito ergo sum)

• Cartesian Dualism
  - mind vs matter
  - Q: How can the brain be influenced by the mind/soul???

• Cartesian model of the universe
  - consists of vortices (“matter in motion”)
  - universe is infinite
  - universe is governed by mechanical laws