



Astronomy 350L

(Spring 2005)



The History and Philosophy of Astronomy

(Lecture 12: Descartes)

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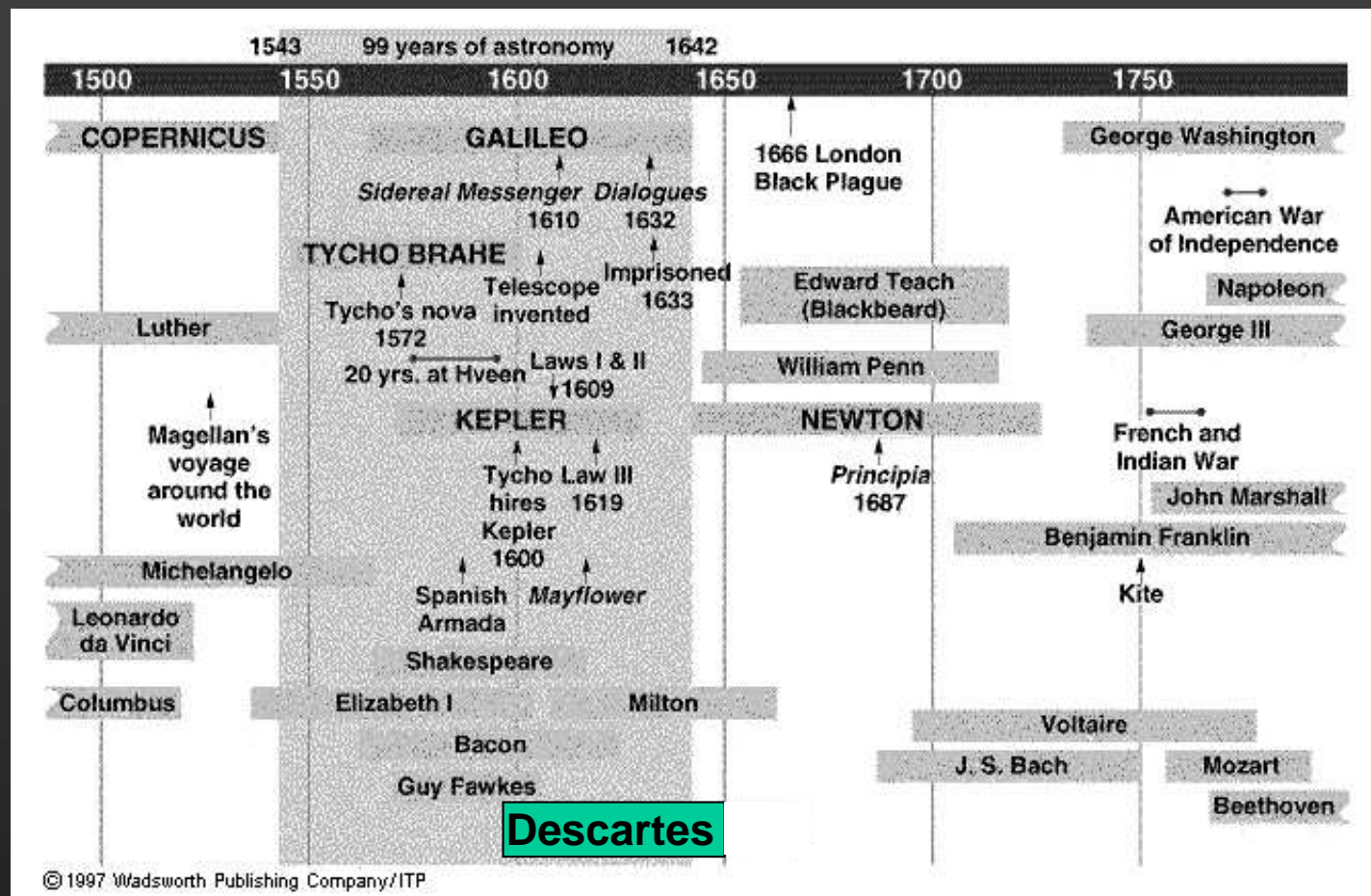
The University of Texas at Austin

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

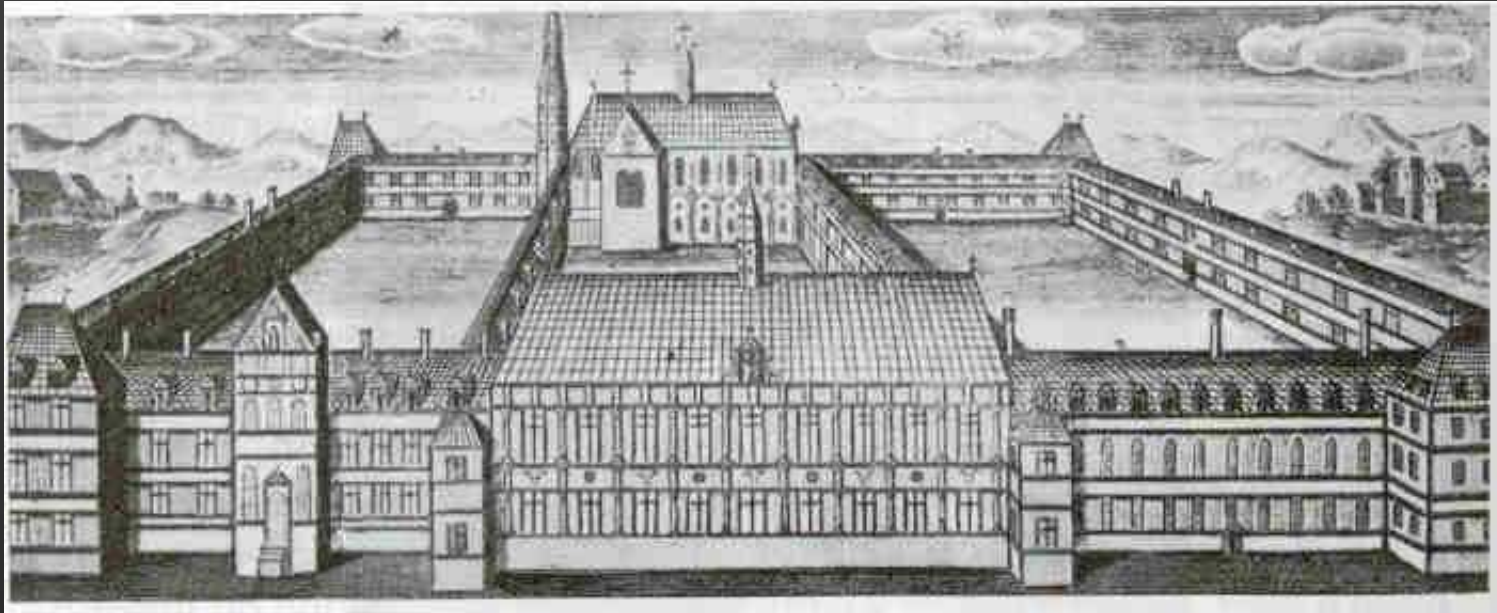


- setting the intellectual stage for Newton
- younger contemporary of Galileo and Kepler

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 (absolutistic) French State
 - founds Academie Francaise (“guardian” of French language)

Descartes: A Desire for Calm and Peace



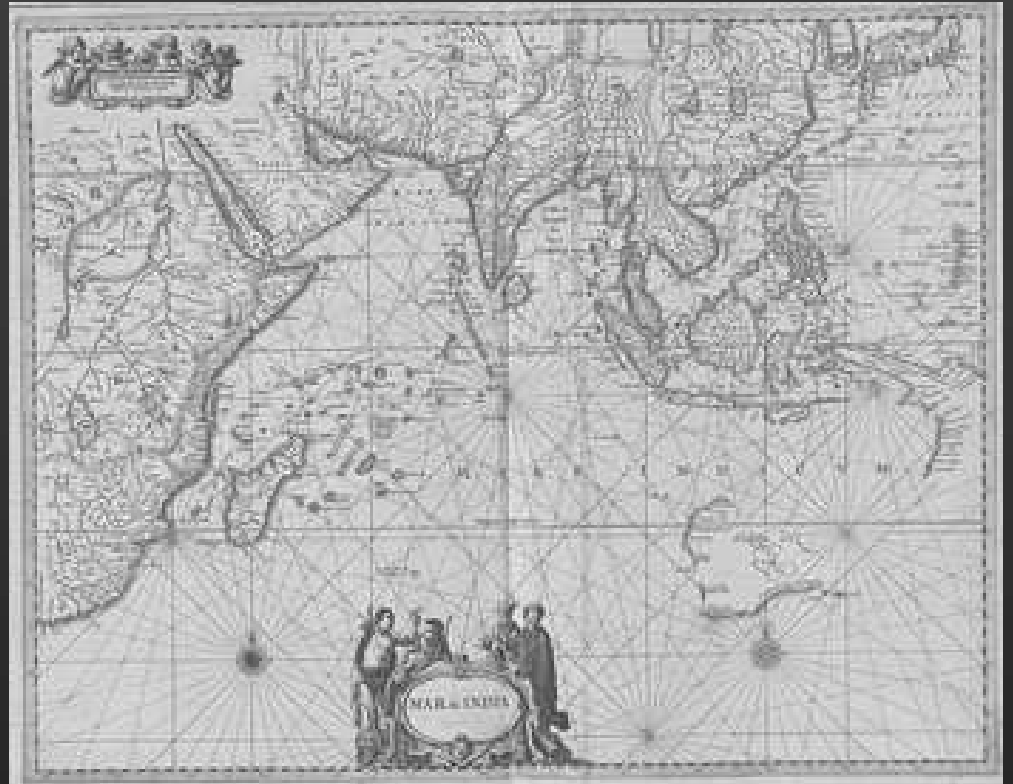
- after having seen the world, Descartes wants quiet time to think and write
- decides to leave bustle of Paris behind
- move to Netherlands (sedentary 2nd half of his life)

Descartes in the Netherlands (1628-49)



- A young, vibrant nation: most tolerant place in Europe then!

Descartes in the Netherlands (1628-49)



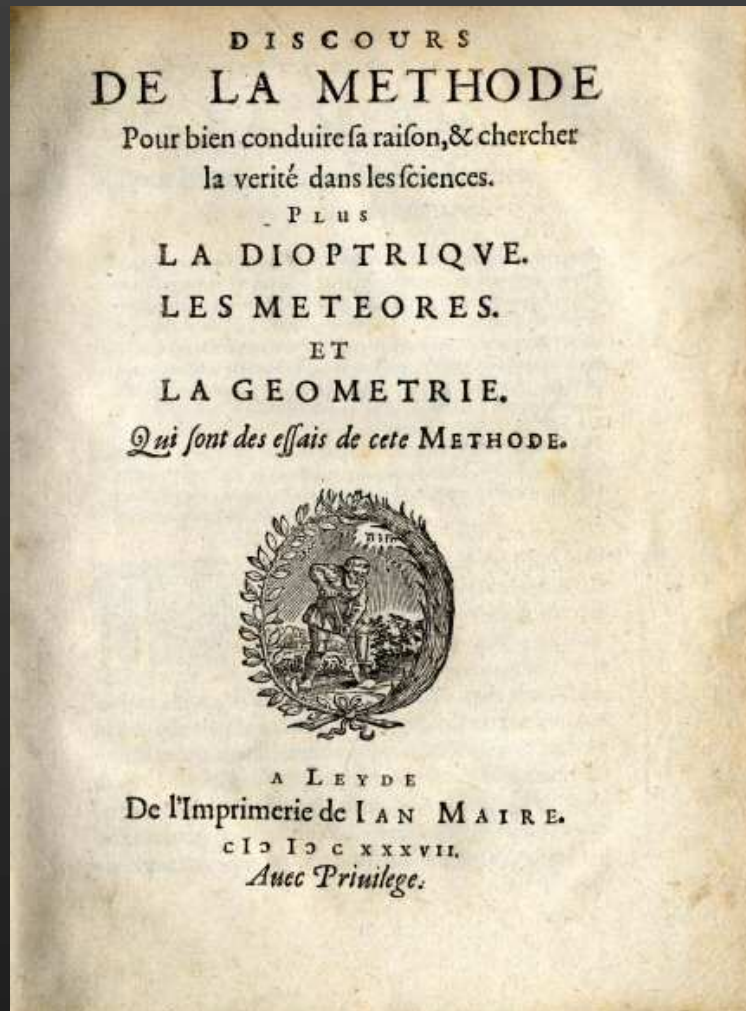
- A superpower of the 17th century!

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-Body Interaction: Clock Analogy

Mind

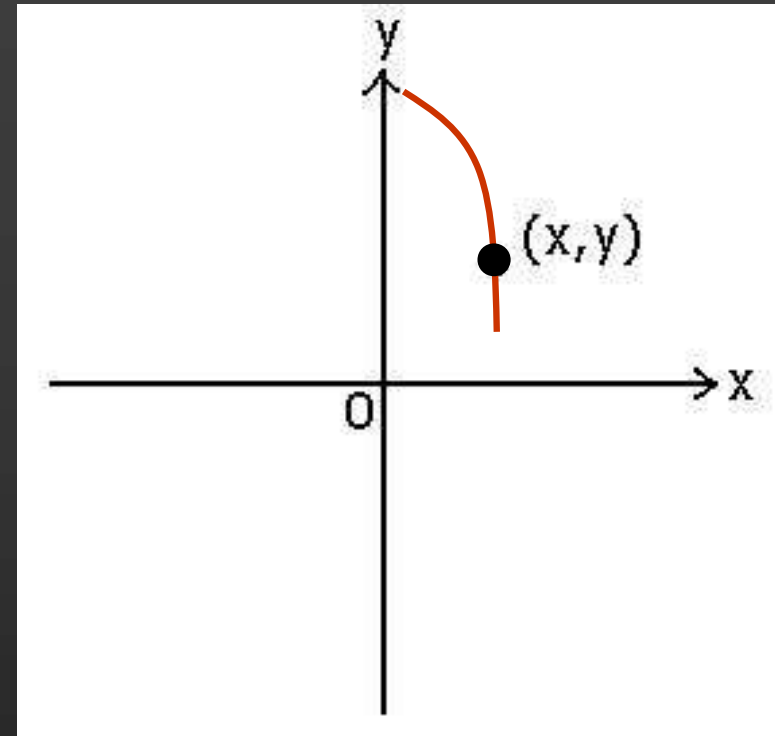
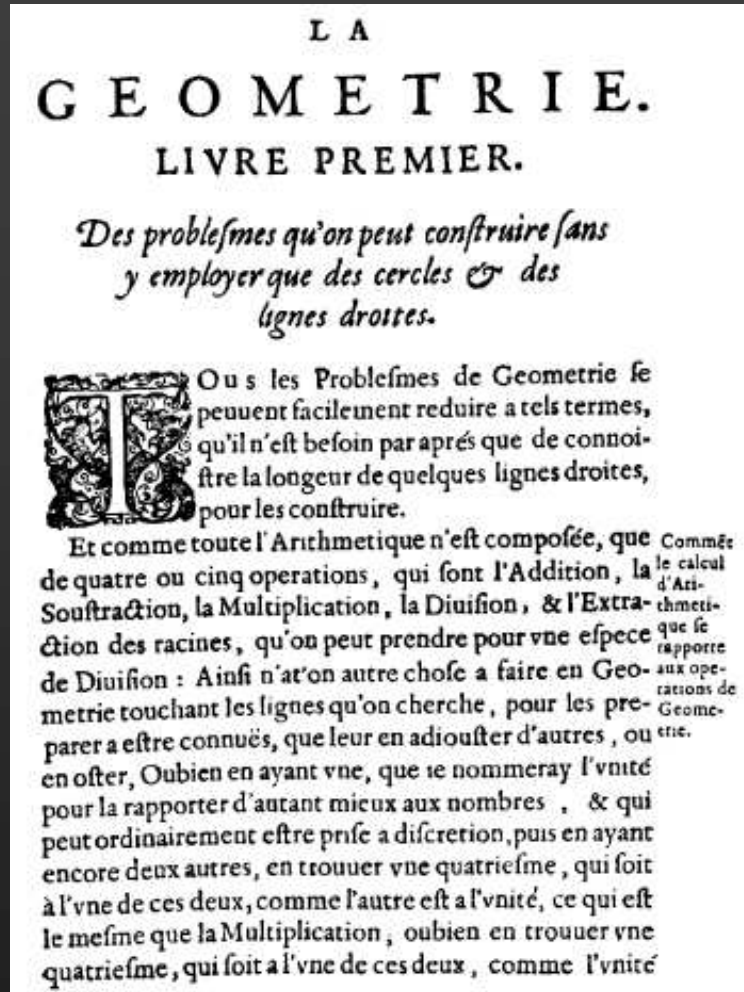


Brain



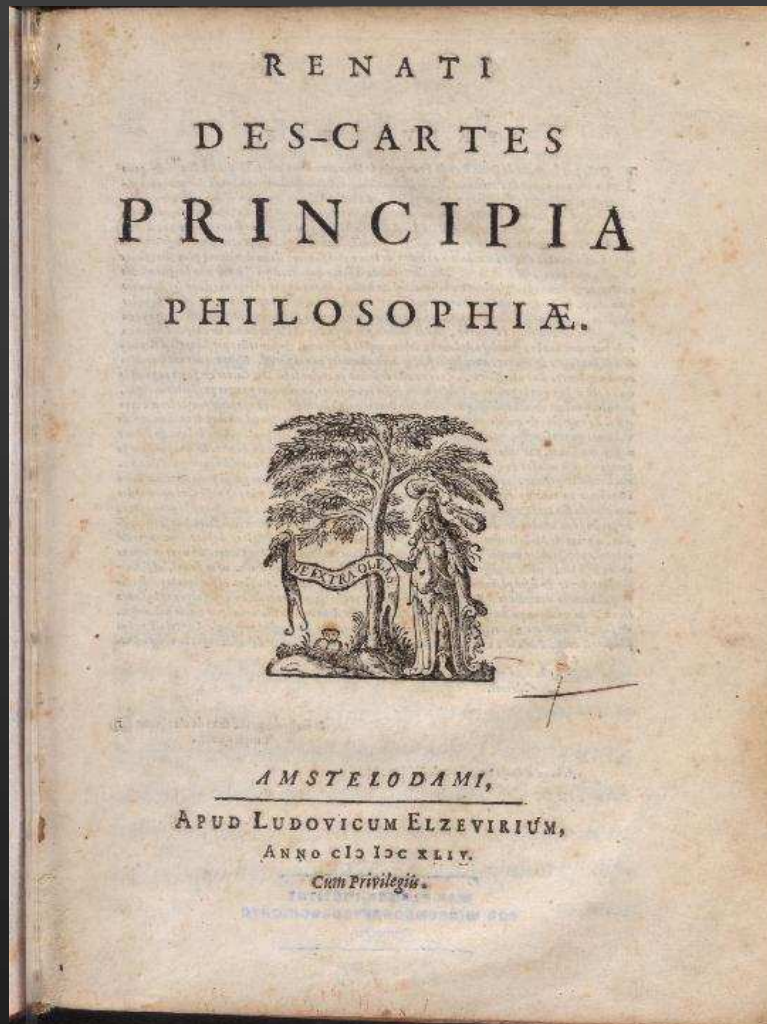
- Mind and body only appear to interact, but are really pre-set in parallelism!
- What about free will? (Brain follows deterministic laws...)

The Mathematician: Analytical Geometry



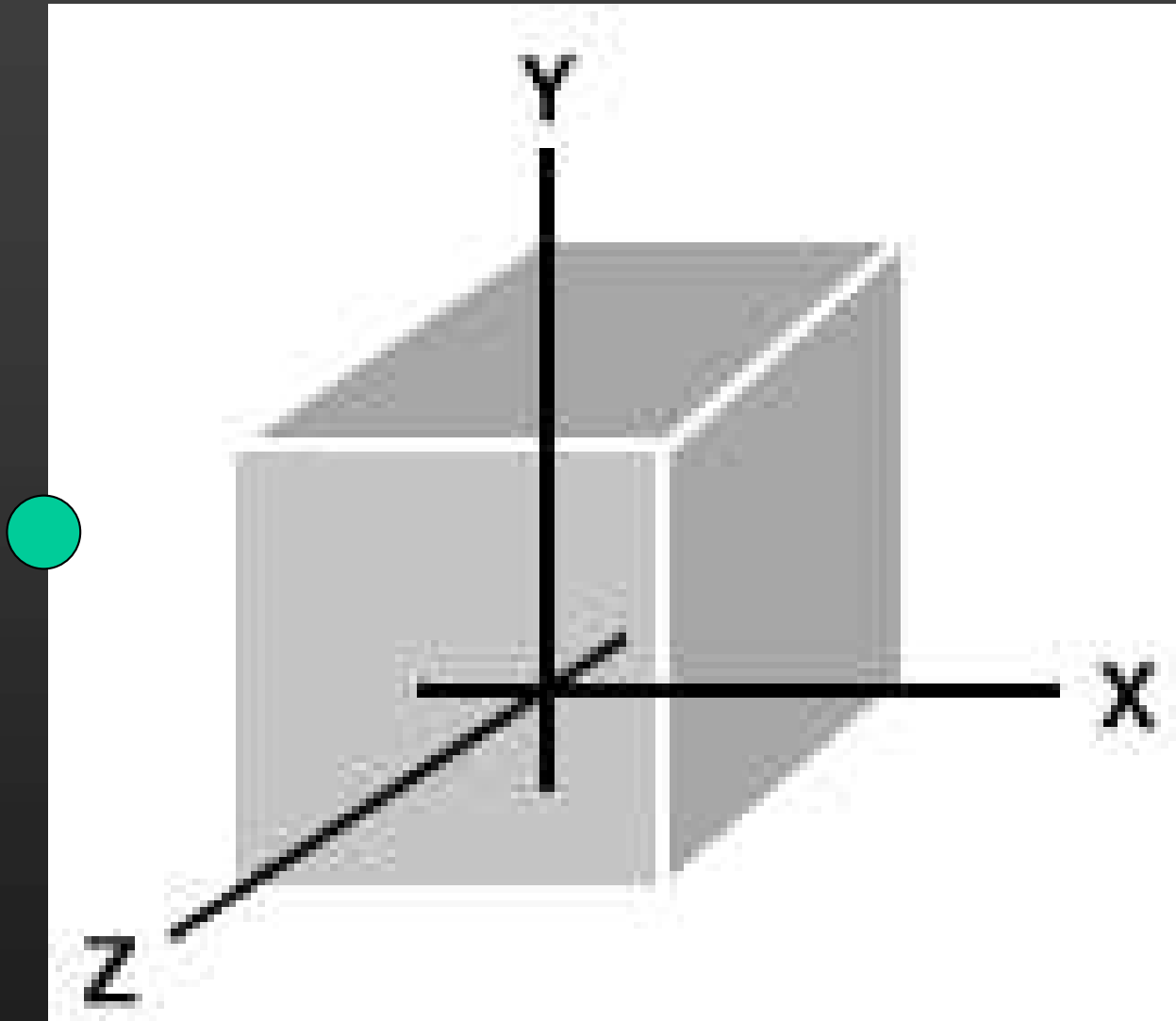
- merge geometry and algebra!
- (Cartesian) Co-ordinates!

The Scientist: Matter in Motion



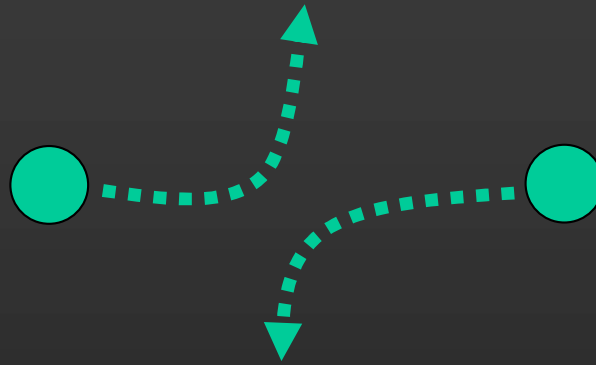
- *Principia Philosophiae*
(Philosophical Principles, 1644)
- Theory of matter, space, and motion
- A mechanical system of the universe (matter in motion)
- An infinite universe

The Scientist: Space and Matter



- begin with empty (“undressed”) space of geometry!

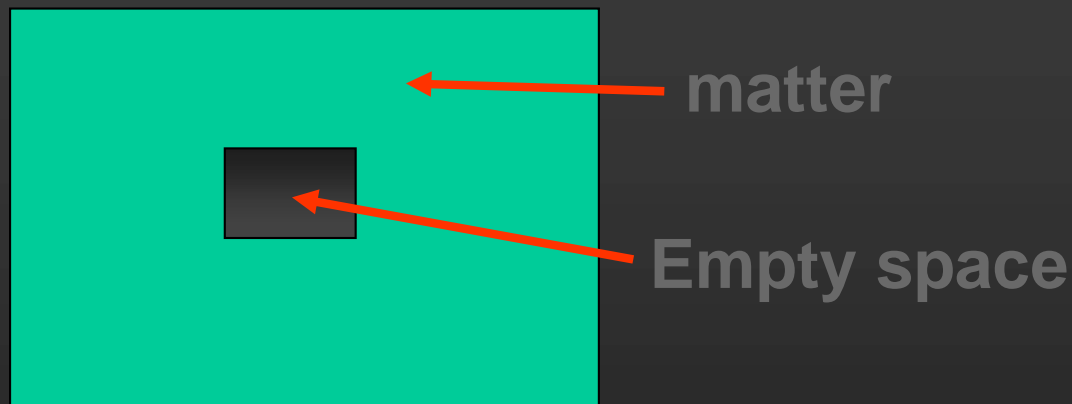
The Scientist: Space and Matter



- Direct collisions can change motion!

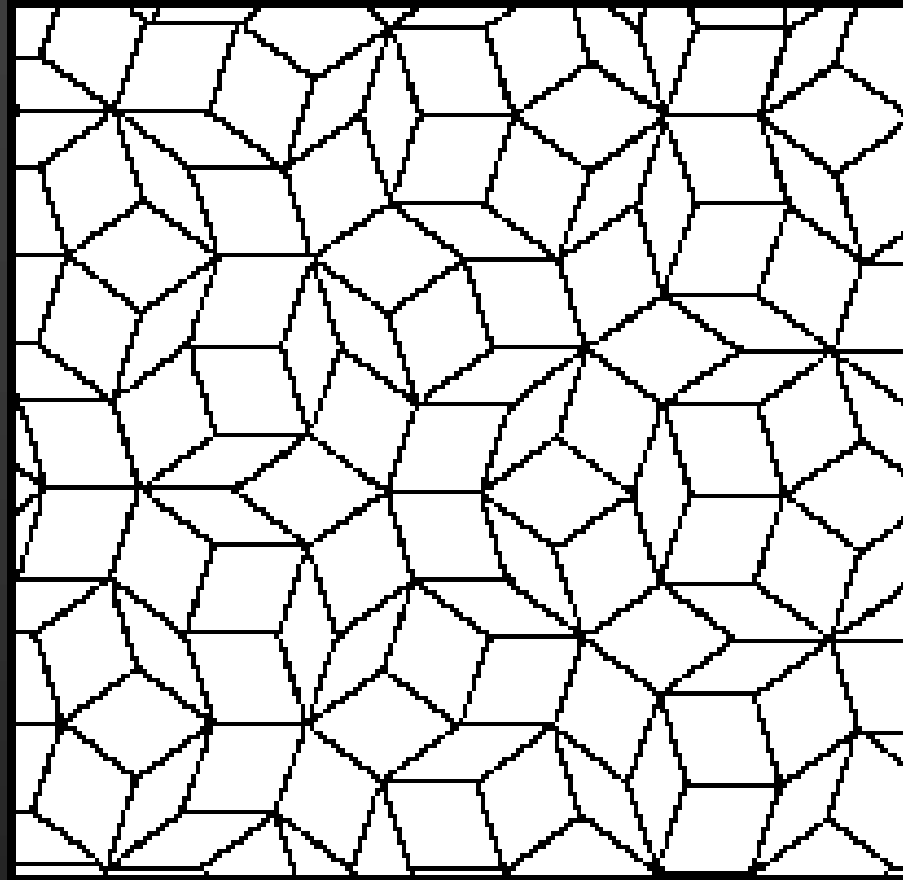
The Scientist: Space and Matter

- There can be no vacuum!
- Assume for the moment that there were empty space!



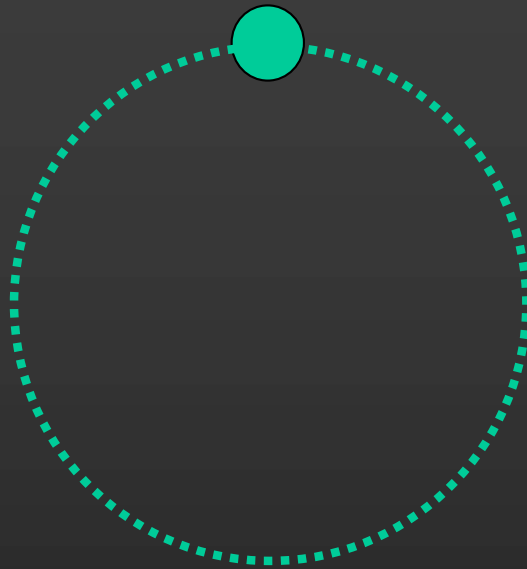
- But: Portion of empty space has “extension”!
- Thus (according to Descartes): There must also be matter (whatever has extension is matter, and vice versa!)

The Scientist: Space and Matter



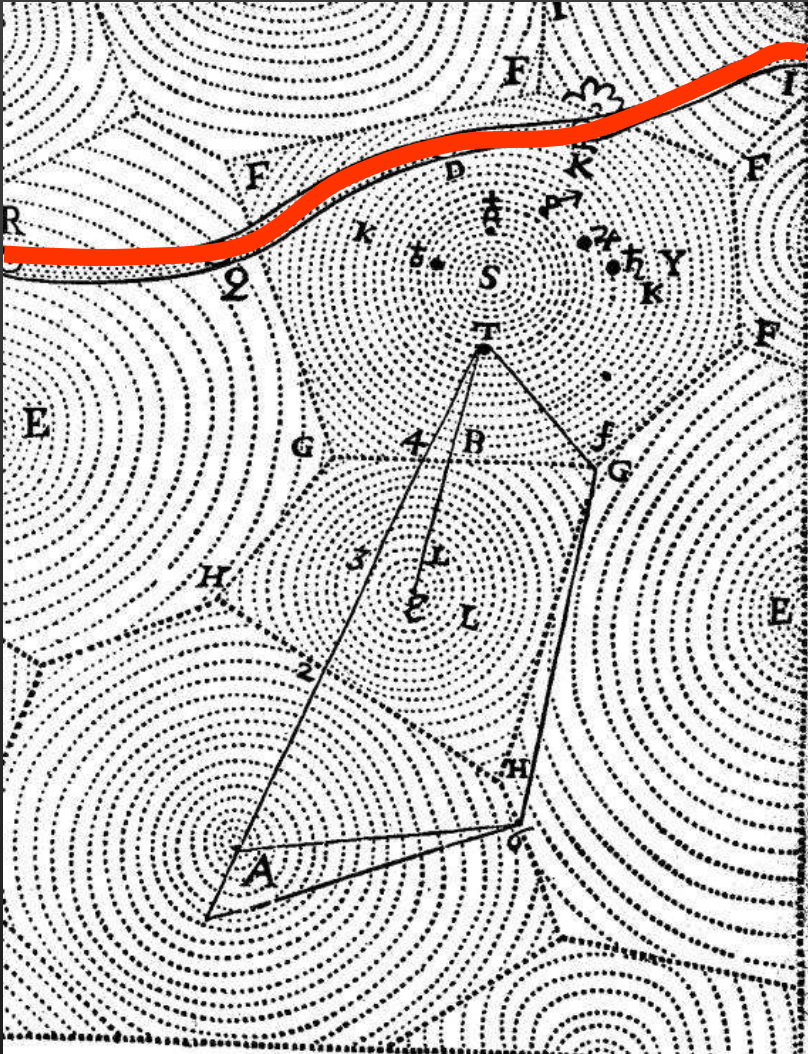
- space is densely packed with material particles!
- No gaps between! —→ World is a *plenum*!

Motion in Completely Filled Space



- particle experiences pushes from adjacent particles!
- path is bent into closed (~circular) shape!

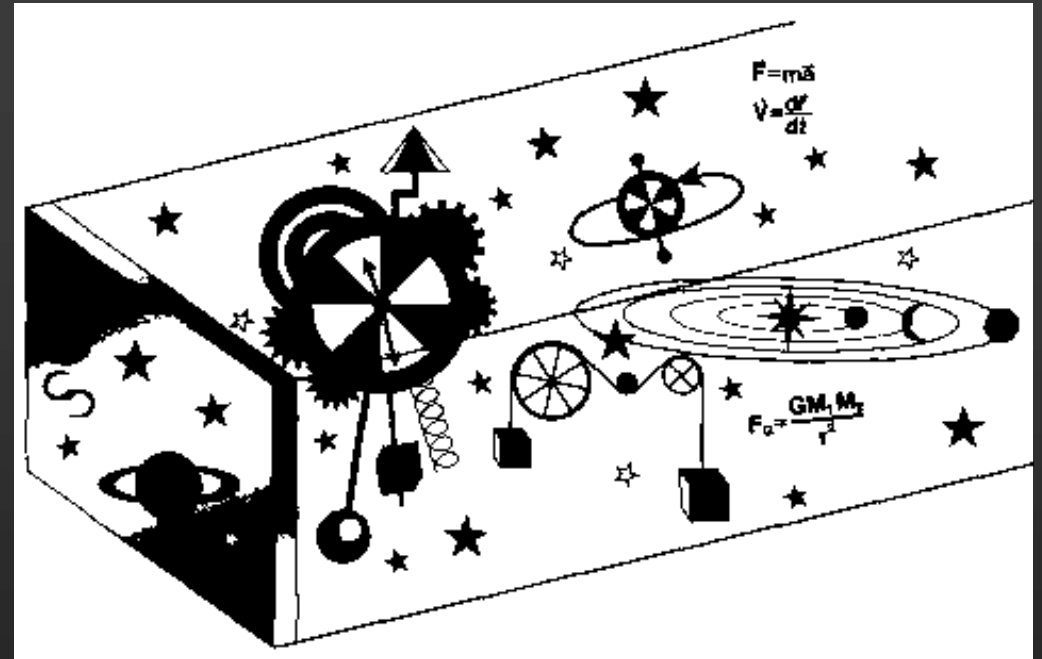
Descartes Model of the Universe



- 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!

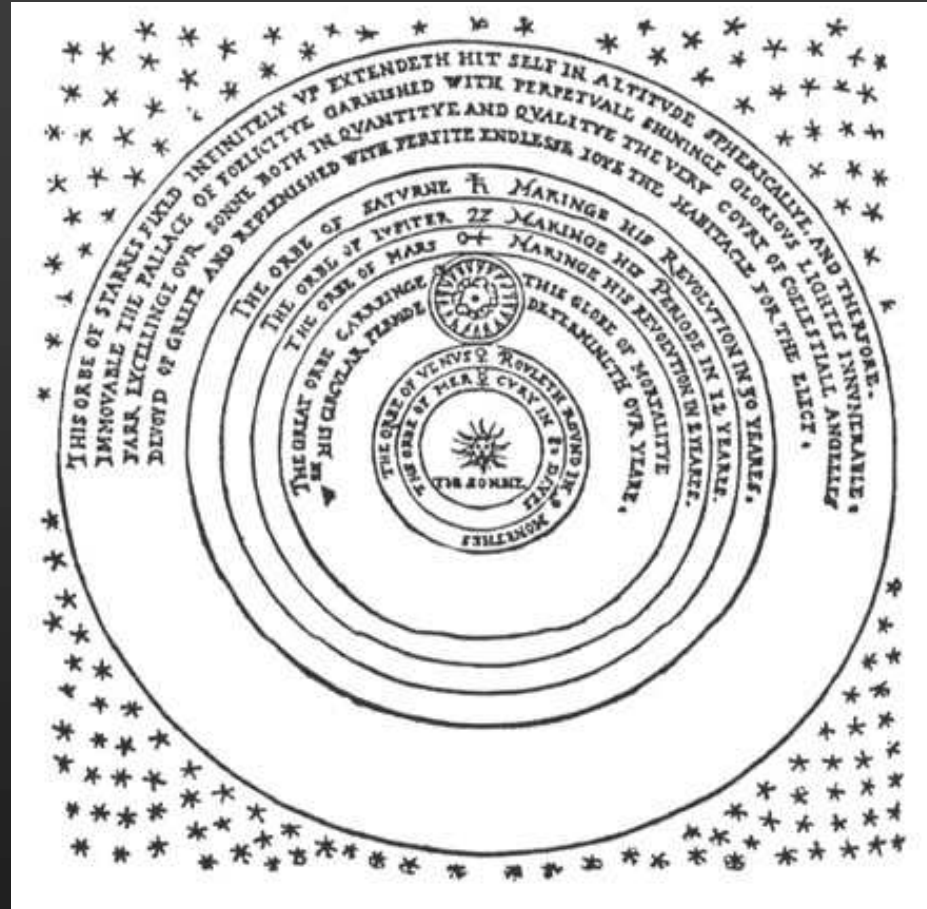
The Clockwork Universe



- 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