

History and Science of Astronomy: Overview

- 3000 BC; Chinese astronomy
- 2700-2100 BC; Egyptians & Babylonians
- 625 BC-150 AD; Greek scientists and geocentric models (Thales, Pythagoras, Democritus, Plato, Eudoxus, Aristotle, [Aristarchus], Apollonius, Hipparchus, Ptolemy)
- 300 BC; Expansion of Greek empire into Middle East (Egypt, Mesopotamia)
- 300 BC-400 AD; Library of Alexandria
- 600-800 AD ; House of Baghdad; compilation of knowledge by Arabs from Egyptians, Greeks, Hindu, Chinese. Development of arithmetic.
- 800-1400 ; Knowledge compiled by Arabs spreads throughout the Byzantine Empire
- 1453 ; Capital of Byzantine Empire falls to the Turks . Eastern scholars move to Europe transferring knowledgeEuropean Renaissance
- 1473—1642 ; Heliocentric models and birth of modern astronomy (Copernicus, Brahe, Kepler, Galilei)
- 1642-1747 Newton: Laws of gravity
- 1905-1915 Einstein's Special and General Theory of Relativity

Scientific Method

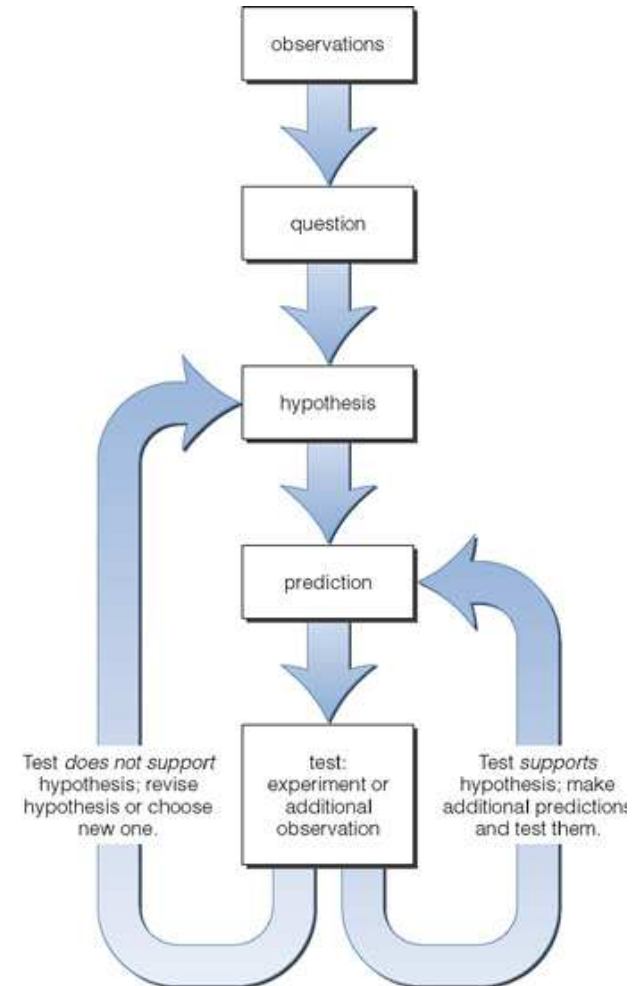
1. Guideline

- a. Compile large number of accurate+independent observation
- b. Propose model/theory
 - à is based on physical principles
 - à explain all existing observations within error bars
 - à does not have 'ad hoc' tweakable parameters
 - à makes predictions that can be tested by future observ.
- c. Check predictions and counter examples

2. A theory/law is more powerful if it can explain a wide array of phenomena with same set of simple concepts + parameters.
 - à Occam's razor. e.g Newton's laws of gravity

3. Non dogmatic

4. Objective?



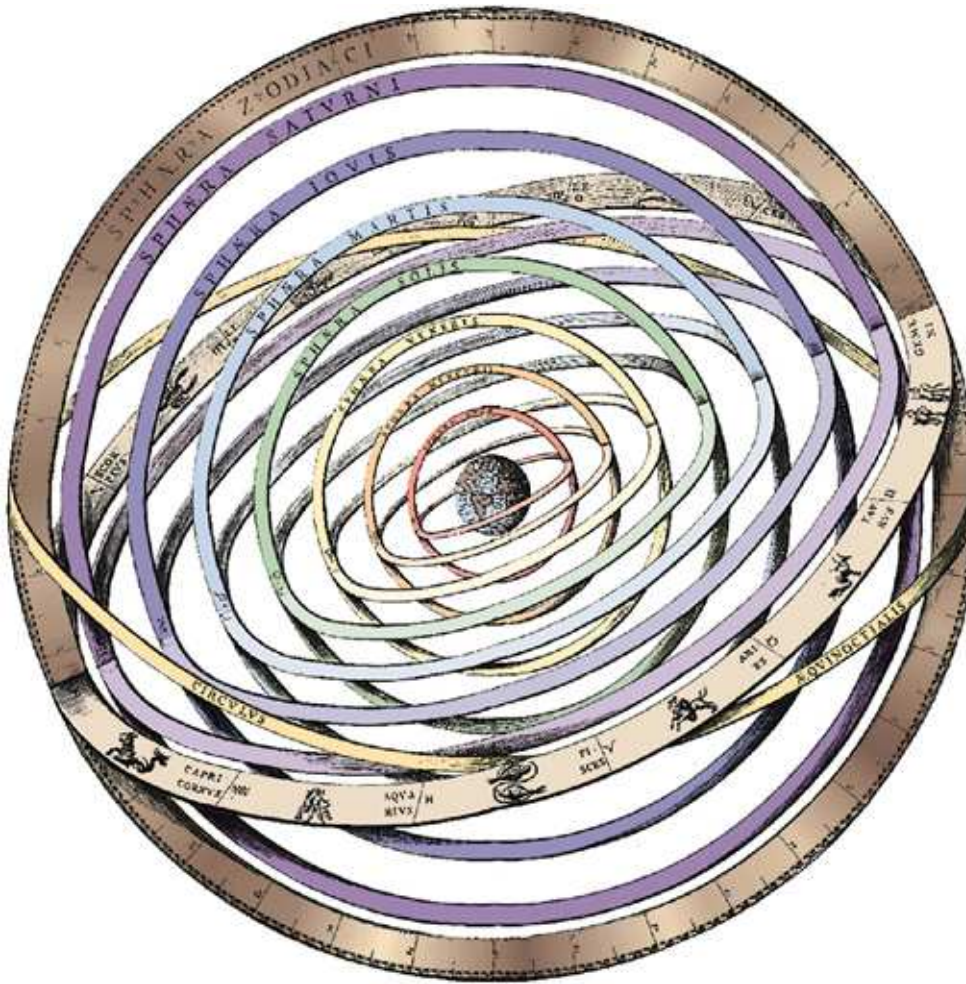
Geocentric Models and Greek Astronomy

Geocentric models and Greek Astronomy

See Class Notes for details

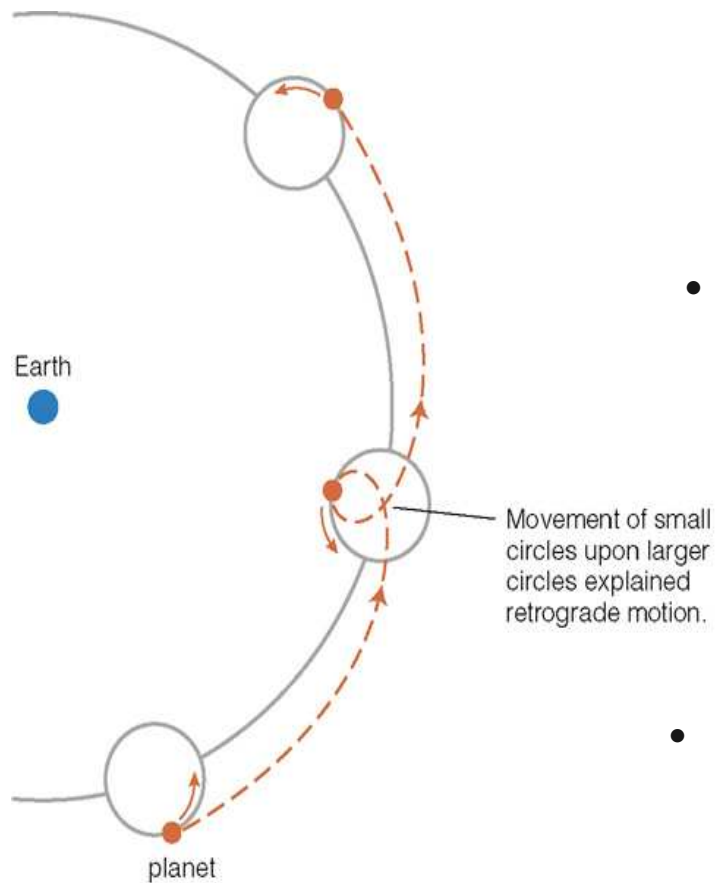
- Period = 625 BC-150 AD
- Main contenders
 - Thales, Anaximander, Pythagoras
 - Democritus
 - Plato
 - Eudoxus, Aristotle,
 - [Aristarchus]
 - Apollonius, Hipparchus, Ptolemy
- Expansion of Greek empire into Middle East (Egypt, Mesopotamia) by Alexander the great; 300 BC
- Library of Alexandria ; 300 BC—400 AD

Geocentric models and Greek Astronomy



- Geocentric models made of perfect shapes: spheres nested within spheres.
- Model used with various modifications by Plato, Eudoxus, and Aristotle

Geocentric models and Greek Astronomy



- Epicycles= small circles whose centers move on larger circles called deferent
- Epicycles introduced by Apollonius and used in geocentric models by Hipparchus and Ptolemy

Geocentric models and Greek Astronomy

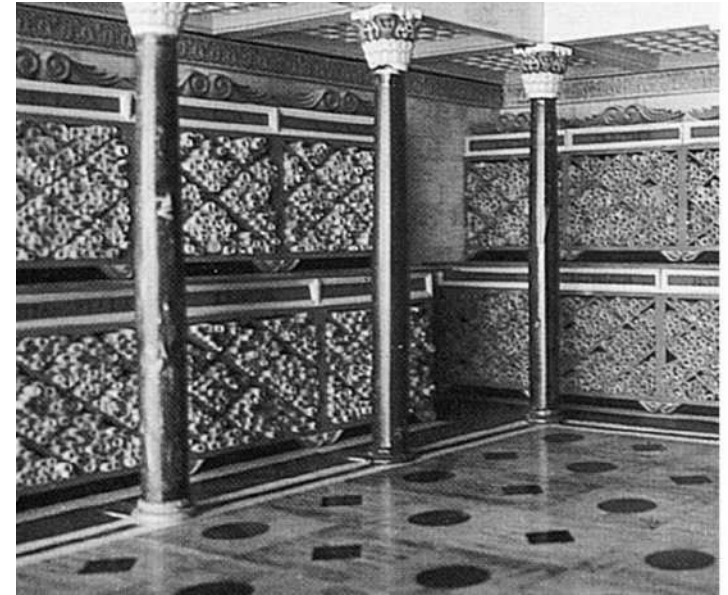
Class Discussion

- How did the Greek scientists (625 BC -140 D) differ from earlier civilisations such as the Chinese, Egyptian and Babylonians ?
- Why did they fail to come up with heliocentric models even after 1000 years?
- To what extent was the scientific method used by the Greeks?

Library of Alexandria



(Artist reconstruction)
Great Hall and Scroll room
in Library of Alexandria



- Founded in Alexandria by Alexander the Great. Lasted 700 years (300 BC –400 AD)
- Half a million scrolls on papyrus. Great learning center.

Heliocentric Models and Modern Astronomy