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
- 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 knowledge ....European 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
   - is based on physical principles
   - explain all existing observations within error bars
   - does not have ‘ad hoc’ tweakable parameters
   - 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.
   - 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 Hipparcus 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

- 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