Greek Astronomy

- ~600 B.C. to ~200 A.D.
- Philosophical and scientific reasoning
 - Thales (624-546 B.C.)
 - Rejection of supernatural reasoning
- Pythagoras (560-480 B.C.)
 - Proved the geometric-algebraic rules
 - $-\,$ The first to teach that the Earth is a sphere
 - 2-sphere model
- Plato (428-348 B.C.)
 - Founded the Academy
 - All heavenly objects move in perfect circles
 - Purely based upon philosophy no observations

Sun-centered Universe

- Aristarchus (310-230 B.C.)
 - C.f. Aristotle (384-322 B.C.); Apollonius (240-190 B.C.)
 - The first person to suggest that the Earth rotates around the Sun
 - Not widely accepted until ~1,800 years later...
- Copernicus (1473-1543 A.D.)
 - Aware of Aristarchus's work
 - Much simpler to explain the retrograde motion
 - No more accurate than Ptolemy's model
- Tycho Brahe (1546-1601)
 - Very precise measurements of motion of stars and planets
 - Convinced that planets must orbit the Sun
 - But still support for the geocentric model? Parallax problem
- Galileo Galilei (1564-1642)
 - Telescope: No parallax problem!
 - Phases of Venus, moons around Jupiter

Kepler's Three Laws

- Kepler (1571-1630 A.D.)
 - Hired by Tycho Brahe
 - Ptolemy's model could not be made to fit Tycho's data better than 8 arc-minutes.
 - Breakthrough: elliptical orbits
 - No more epicycles
 - Three laws of planetary motion derived from Tycho's data
 - Elliptical orbits
 - Equal area orbits
 - Period-distance relation
- Newton (1642-1726 A.D.)
 - Explained Kepler's laws by universal laws of gravity

Earth-centered Universe

- Pythagoras (560-480 B.C.)
 - 2-sphere model
 - No planet motion taken into account
- Eudoxas (400-347 B.C.)
 - Many-sphere model
 - Moon, Mercury, Venus, Sun, Mars, Jupiter, Saturn, then stars
- Aristotle (384-322 B.C.)
 - Improved Eudoxas's model to fit observations better
- Apollonius (240-190 B.C.)
 - Epicycles: could explain retrograde motion
- Ptolemy (100-170 A.D.)
 - Almagest
 - Excellent agreement with observations (epicycles+equant+deferent)
 - A standard model of the universe for 1.400 vears

Is the universe Finite or Infinite?

- Aristotelian universe (many-sphere model)
 - FINITE
 - The starry sphere is the edge of the universe
 - No "voids" no empty space. Full of ether.
- Epicurean universe (atomic universe)
 - INFINITE
 - No ether infinite number of atoms in voids with infinite extent
 - Heaven and the Earth made of the same atoms: suppressed by religion
- Condemnation in 1277 (Paris)
 - There is no place for God to live in the Aristotelian universe.
 - God is without limit, and therefore the universe must be without limit.
 - Aristotelian universe was forced to be modified: the starry sphere was made to extend infinitely.

Finite or Infinite?

- Current observations show no compelling evidence for the "starry sphere" or the "edge of the universe", within our cosmic horizon.
- However, some people claim that they have found evidences.
 - <u>Example</u>
 - We still don't know if the universe is finite or infinite.
- What do you think? Why?