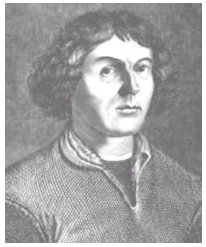
Copernican Revolution

- Motion of the sun & planets
- Ptolemy's *Almagest*
- Copernicus' *de Revolutionibus Orbium Caelestium, (Concerning Revolutions of the Heavenly Spheres),* 1543
- Galileo refutes Ptolemy with his observations of the phases of Venus



Nicolai Copernicus (1473-1543)

Copernican Revolution: questions on reading assignment

1. Retrograde or normal motion of a planet concerns
   a. whether it rises in the east or west
   b. its motion with respect to the stars behind it.
2. Ptolemy (200AD) believed
   a. The earth moved around the sun once a year
   b. The sun moved around the earth once a year
   c. The earth moved around the sun once a day
   d. The sun moved around the earth once a day
3. We now know… (Use same answers as in #2.)

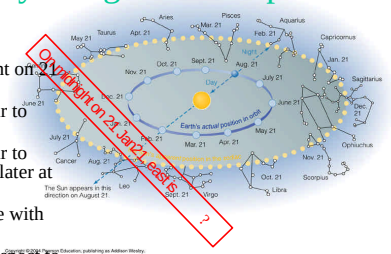
The Observations

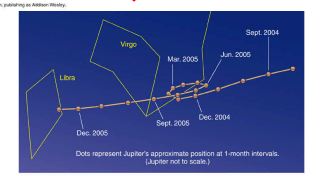
- We pretend to be Greek astronomers in 100 AD.
  - Free planetarium program Celestia (www.shatters.net/celestia)

4. View on xxx's birthday. The sun is in front of which constellation?
5. Do the stars move with respect to each other?
   a. Yes
   b. No
6. The planets move with respect to the stars because
   a. The planets move.
   b. The Earth, from where we view the planets, moves.
   c. Both a & b are correct
   d. None of above answers are correct.

Motion of the sky using celestial sphere

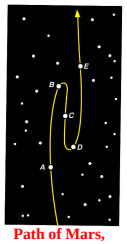
- Draw Cancer at midnight on 21 Jan.
- How does Cancer appear to have moved at 1am?
- How does Cancer appear to have moved a few days later at midnight?
- Do stars in Cancer move with respect to each other?
- Planets do move with respect to the stars.
  - Normally planets move eastwardly from night to night
  - Sometimes they move westward. Retrograde motion
  - This is the major astronomical problem until about 1630





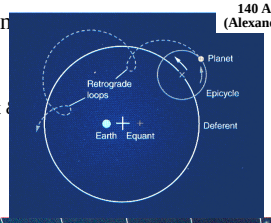
Ptolemy's *Almagest* (*The Greatest*), 140AD

Ptolemy. 140 AD (Alexandria)

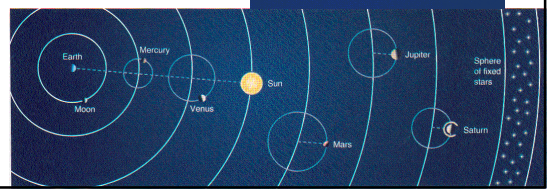


Path of Mars, etc. as seen from Earth

- Ptolemy's model to explain planetary motion
  - Earth is at center.
  - Motions are circular.
  - Planets are on a deferent & epicycle

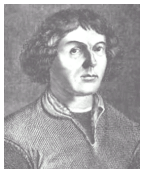


epicycle



Blue figures are from Seeds, *Horizons: Exploring the Universe.*

[3.3]

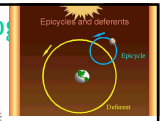


Copernicus proposed the idea that sun is at ~~center~~

WE ARE HERE!

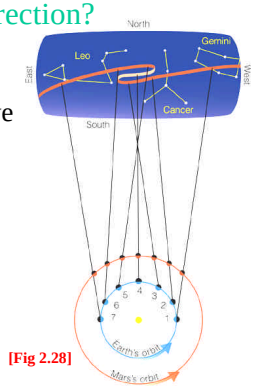
- Copernicus proposed that each planet is on circular orbit about sun.
  - Simpler than Ptolemy's model
  - Accuracy is worse than Ptolemy's model
  - Model violates Aristotle's "truths"
    - Heavenly objects, being perfect, move in a circle, which is the perfect shape.
    - The earth is stationary at the center.
    - Heavenly objects move at constant speed.
    - Base objects seek a state of rest.
  - Copernicus wrote *de Revolutionibus* and published it decades later at death.

Why do planets sometimes move in retro[grade] direction?



epicycle

- Earth moves in orbit around sun.
- The other planets move on their own orbits around the sun.



[Fig 2.28]

http://web.cuug.ab.ca/~kmcclary/ORRERY/fastsolar.html shows why this really happens (click "Center", "Earth")

simulation