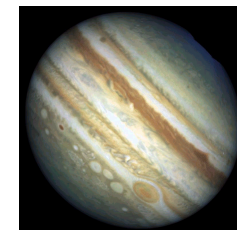


Formation of Solar System—February 21

- Test 2
 - Mon, Feb 28
 - Covers
 - 6 questions from Test 1
 - Telescopes
 - Solar system
 - Format similar to Test 1
- Questions
 - Why are rocky planets close to the sun?
 - Why is solar system a disk?
- Missouri Club
 - Thurs, 7-8pm, room 1410
 - Fri, last 10 minutes of class

Terrestrial & Jovian Planets

- Why are the planets near the sun dense (rock) and the farther planets less dense (like water)?



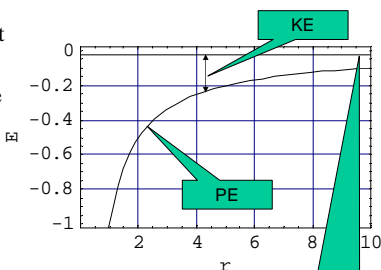
Jupiter;
1.3 gm/cm³



Mercury;
5.4 gm/cm³

Collapse of the Protosolar Cloud

- I am a hydrogen molecule in the cloud that will become the sun.
 - My energy is kinetic (due to motion) and potential (due to gravity).
 - Energy = KE + PE
 - = $\frac{1}{2} m v^2 - G M m/r^2$
 - Speed v
 - Distance r to center of cloud
1. When I fall from r = 5 to r = 1, my KE (and temperature) increases by a factor ____

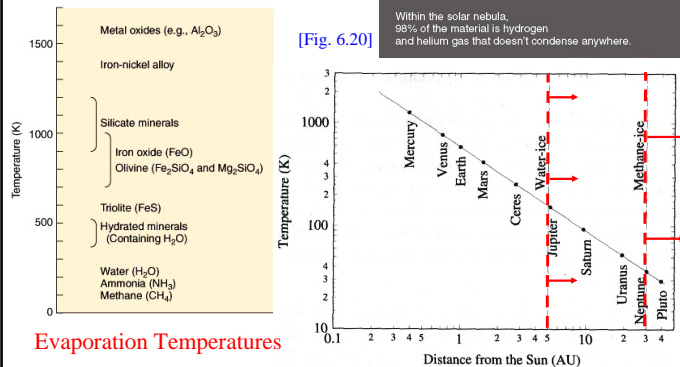


- a. About 2
- b. About 3
- c. About 5
- d. More than 10

Total energy, unchanged as molecule falls. Does change if radiation occurs

Thermal history of the Solar System

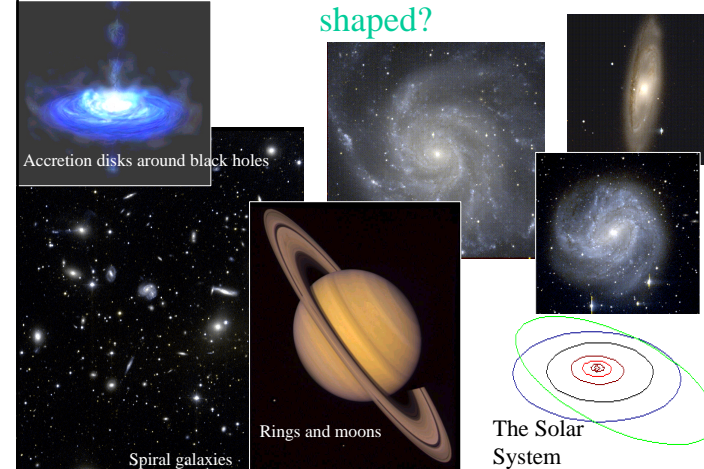
- Terrestrial vs. Giant Planets
- Asteroids vs. comets



Giants vs. Terrestrials

- In inner solar system.
 - Lighter elements evaporated away.
 - Planetesimals contained only heavy elements.
 - Growth stopped at Earth-sized planets.
 - Continuing impacts with planetesimals altered the planets
 - Earth's moon
 - Reversal of Venus' rotation, etc.
 - Dumped much of atmospheres onto planets
- In outer solar system.
 - Ices as well as silicates available for solid bodies.
 - Larger protoplanets resulted.
 - These cores able to attract surrounding H, He gas in order to build giant planets.
 - Gravitational field of giant planets perturbed orbits of remaining planetesimals.
 - Most comets ejected into Oort Cloud

Why is the solar system spinning & disk shaped?

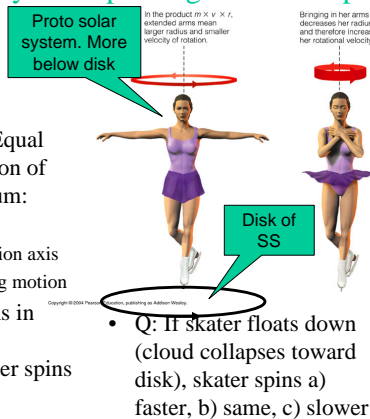


Why is the solar system spinning & disk shaped?

- Skater represents protosolar system
- Kepler's Law of Equal Areas, Conservation of Angular Momentum:

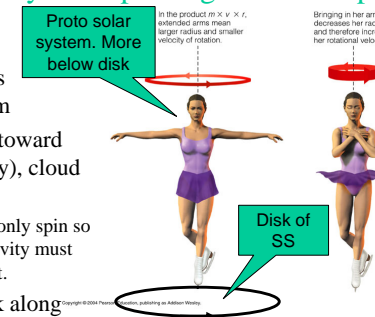
$$L = m r v$$

r is distance to rotation axis
v is speed of rotating motion
- If skater pulls arms in (cloud shrinks horizontally), skater spins faster.



Why is the solar system spinning & disk shaped?

- Skater represents protosolar system
- If cloud shrinks toward axis (horizontally), cloud spins faster.
 - Real cloud can only spin so fast because gravity must hold gas in orbit.
- Cloud can shrink along spin axis without butting against angular momentum. Cloud can flatten.



The Solar Nebula

[Fig 6.27]

