

Outer Planets (Jupiter, Saturn, Uranus, Neptune, and Pluto)

Pluto is not a Jovian Planet

JUPITER - 5.2 AU from the Sun

- very large planet
- huge mass makes Jupiter more massive than all other planets combined
- Density = mass/volume  $\approx 1.3 \text{ gm/cm}^3$   
Terrestrial planets are approximately  $5 \text{ gm/cm}^3$
- Spectra Support. This difference and show presence of helium as well
  - Absorption Spectra
- Atmosphere - thickens w/ depth gas  $\rightarrow$  liquid
  - below atmosphere = "sea" of liquid hydrogen
- Abundances of Elements in Sun
- Theoretical Models and measurements of heat loss from atmosphere imply interior is very hot - heat drives convection motions
- Active weather systems:
  - a. Volume determines amount of heat retained
  - b. Surface area is responsible for amount of heat distributed
- Coriolis Effect = planet spinning = gets bigger as object spins  
apparent deflection all objects seem to under-go.
- Cloud Motions show rapid rotation of planet = 10 hour days
- Great Red Spot = huge hurricane
- Extensive Satellite Systems
  - a. most lie in equatorial plane and orbit in same direction
  - b. form mini-solar systems
  - c. 4 largest moons = Io, Europa, Ganymede, Callisto
    1. Io = extreme volcanic activity (sulfur)
      - a. tidal forces exerted on it by Jupiter
    2. Europa = heated and partially re-surfaced.
      - b. Europa and Ganymede = ice  $\rightarrow$  life  $\rightarrow$  liquid water

maybe under surface

(no life and liquid water)



- Strong magnetic field = caused by rotation and convection in interior

Saturn = 9.5 AU from the Sun

- Density = mass/volume =  $\approx .7 \text{ gm/cm}^3$  - lowest of any planet
- Spectra shows rich in hydrogen, helium, <sup>as</sup> hydrogen compounds.
- Bright, wide ring system
- Extensive satellite system (similar to Jupiter)
  - a. Titan (nearly size of Mercury)
    - i. atmosphere - rich in nitrogen / seas of hydrocarbon eth

Uranus 19 AU from the Sun

- SA =
- a. Storms like Jupiter; Great dark spot as on Jupiter
  - b. large tilt of rotational axis =  $90^\circ$  - something hit it? (no one knows)

Neptune 30 AU from the Sun

BOTH HAVE = methane = blue color

- similar in size, atmosphere, spectra, interiors, = water
- faint rings
- extensive satellite systems
- Atmosphere = hydrogen and its compounds

Sizes in comparison

Jupiter  $\rightarrow$  Saturn  $\rightarrow$  Neptune  $\rightarrow$  Uranus  $\rightarrow$  Earth  $\rightarrow$  Pluto

Space is given with outer planets

Pluto rock and ice in space