

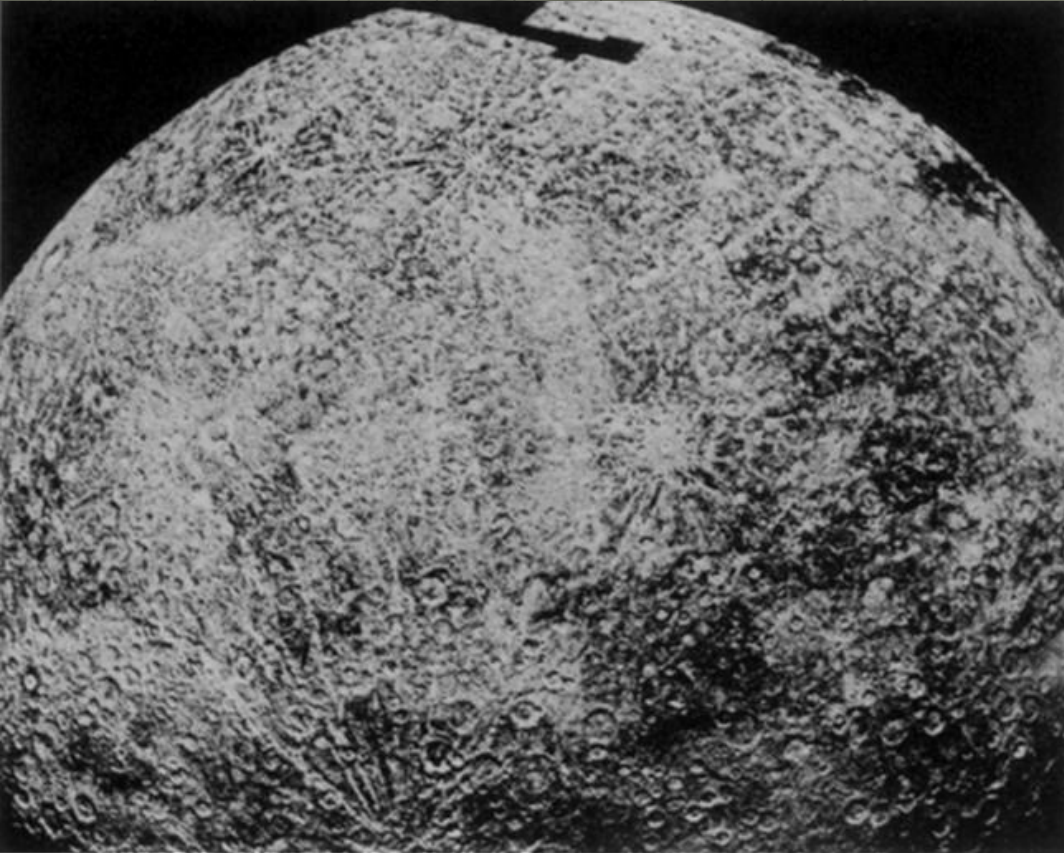
- ◆ Saturn lies twice as far away from the Sun as Jupiter. If Jupiter takes roughly 12 years to complete one orbit, how long does it take Saturn?
 - A. Less than 6 years
 - B. Roughly 6 years
 - C. Roughly 24 years
 - D. More than 24 years

The Planets

- ◆ Objectives
 - General trends of planets
 - Some cool oddities



Mercury



Mass = $0.05 * M_{\text{earth}}$

Similar to the Moon

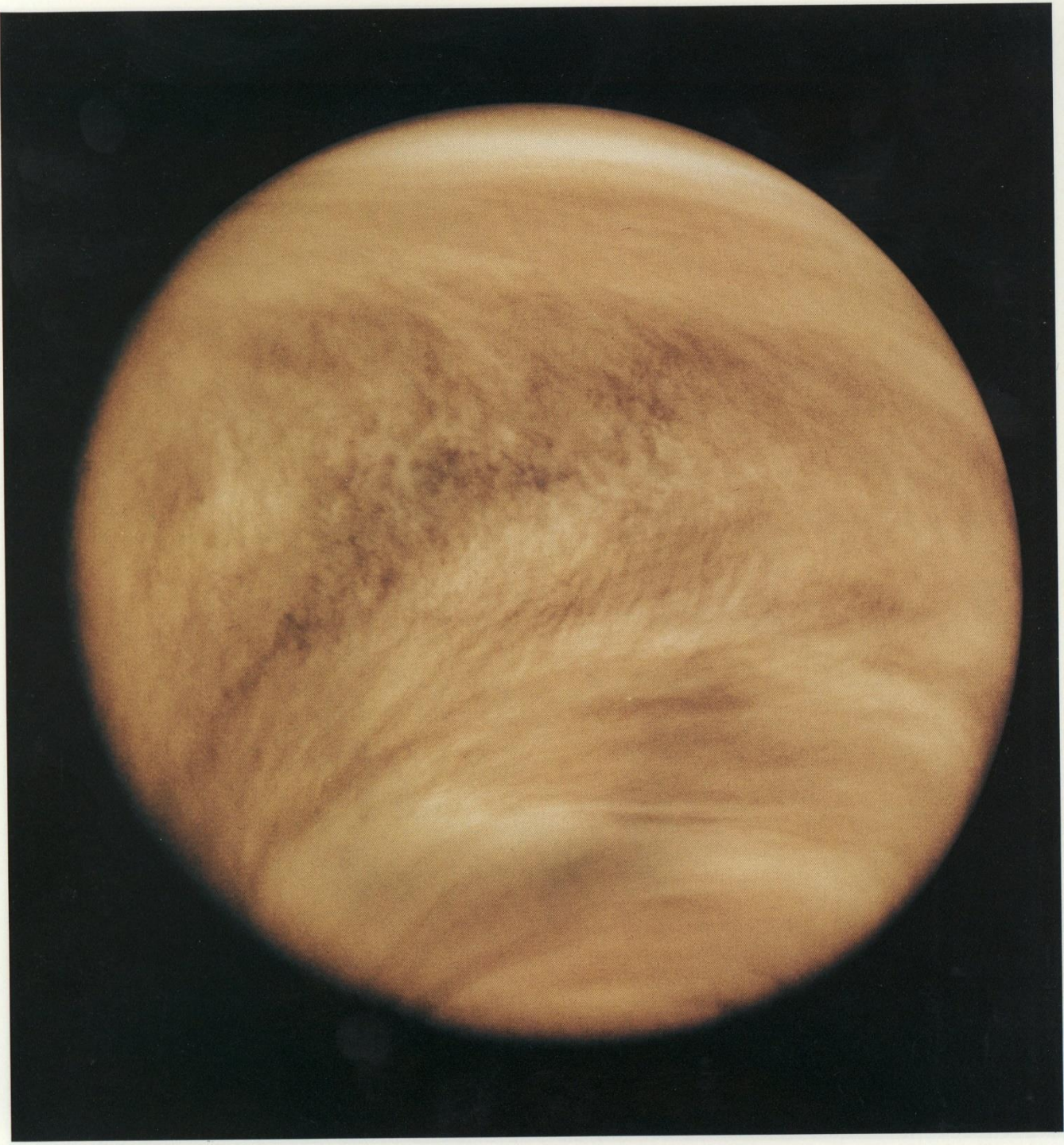
- No atmosphere
- Lots of craters
- Tidally locked with the SUN!!!
- Only shows one face to the Sun



Venus

- ◆ Mass = $0.8 * M_{\text{earth}}$
- ◆ 450° C
- ◆ Rains sulfuric acid
- ◆ Thick atmosphere

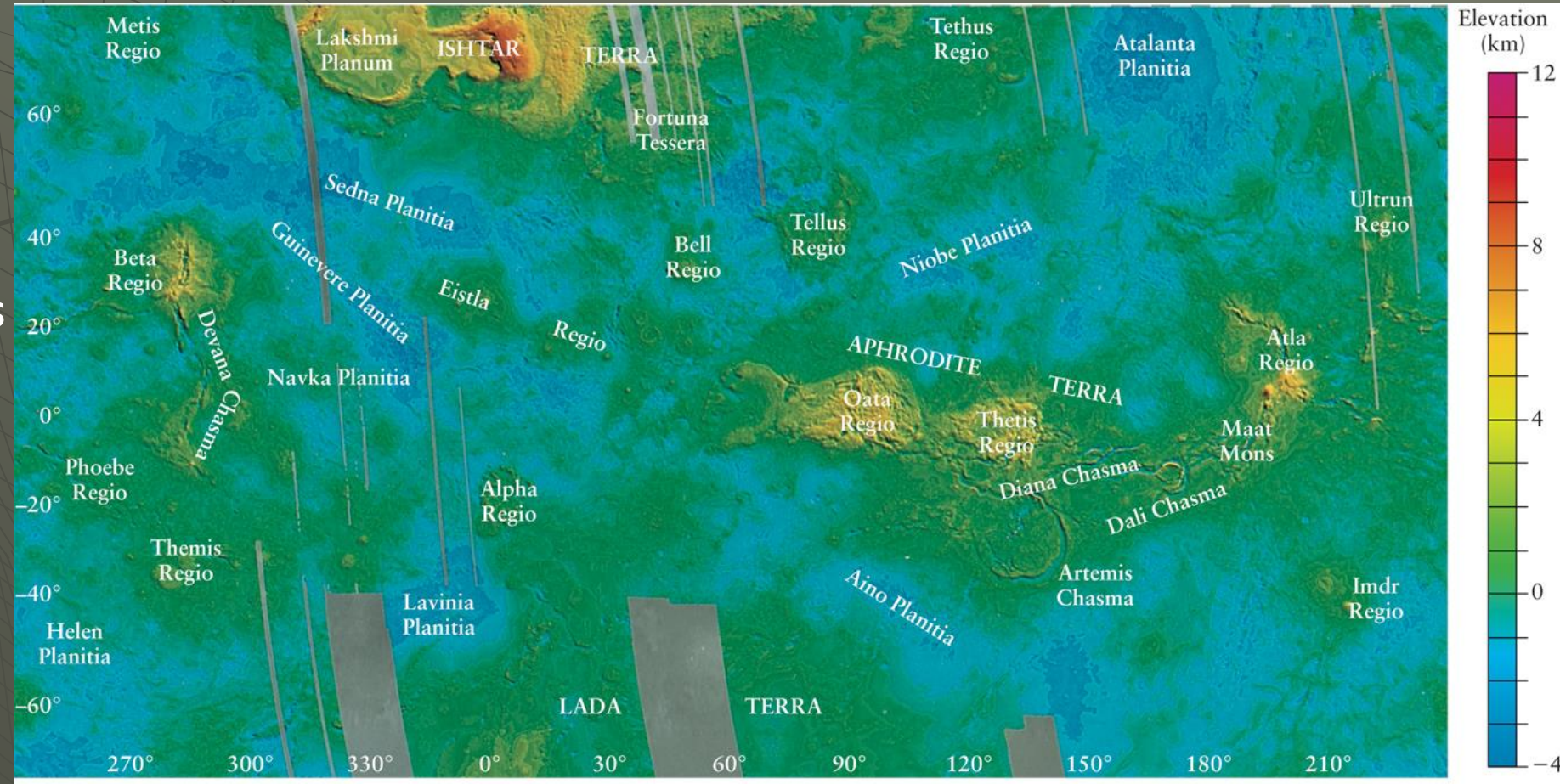
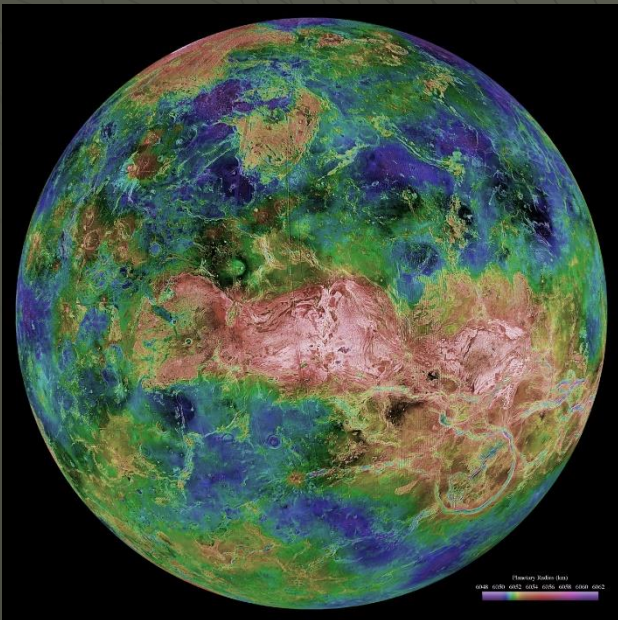
- ◆ Rotates backwards!
 - Lots of theories
 - Nothing conclusive



Magellan Spacecraft to Venus

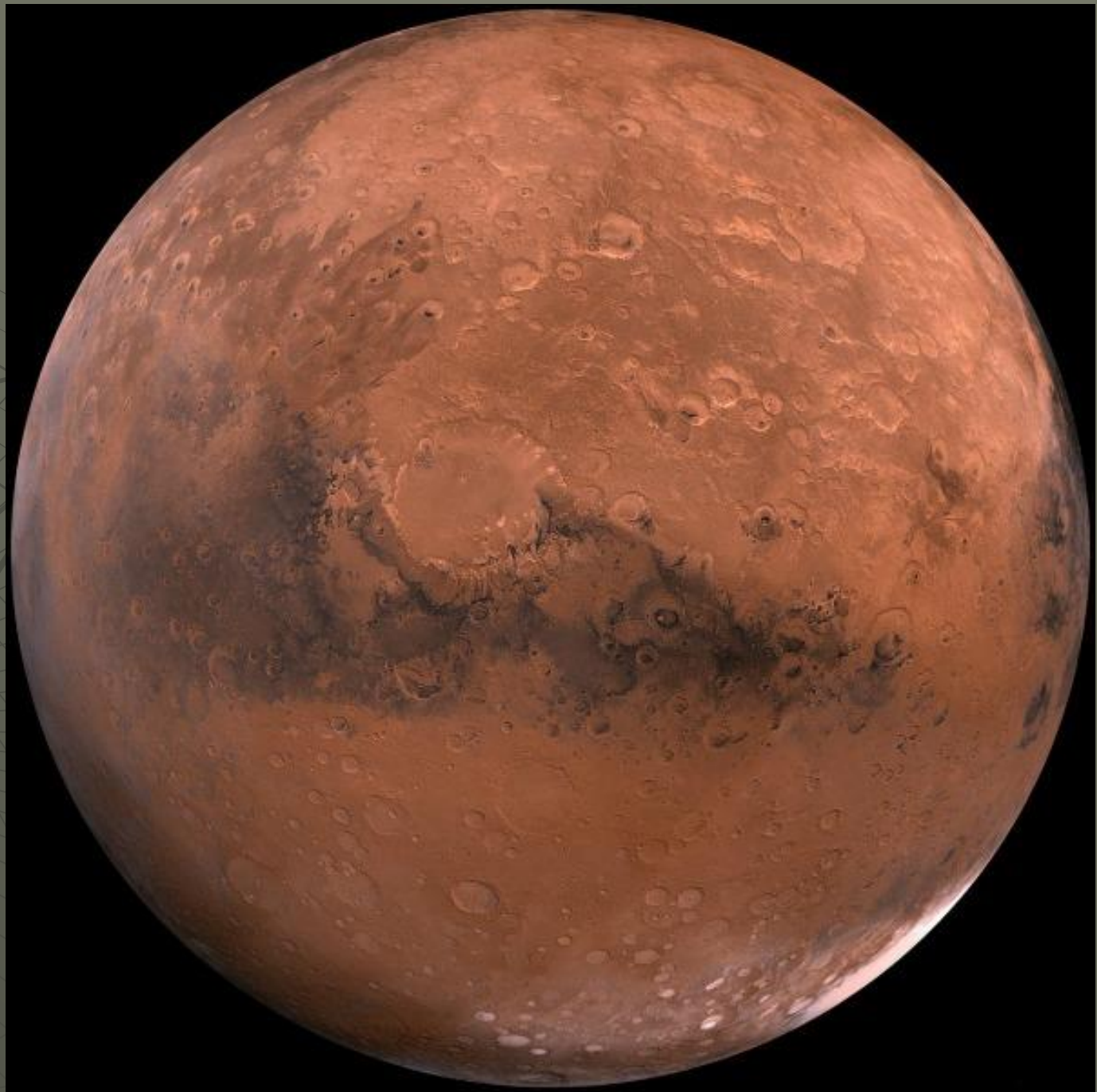
- No oceanic rifts
- No subduction zones
- **No plate tectonics on Venus**
- 1600 large crater impacts
- Very few small craters

- 65% of surface are lava plains



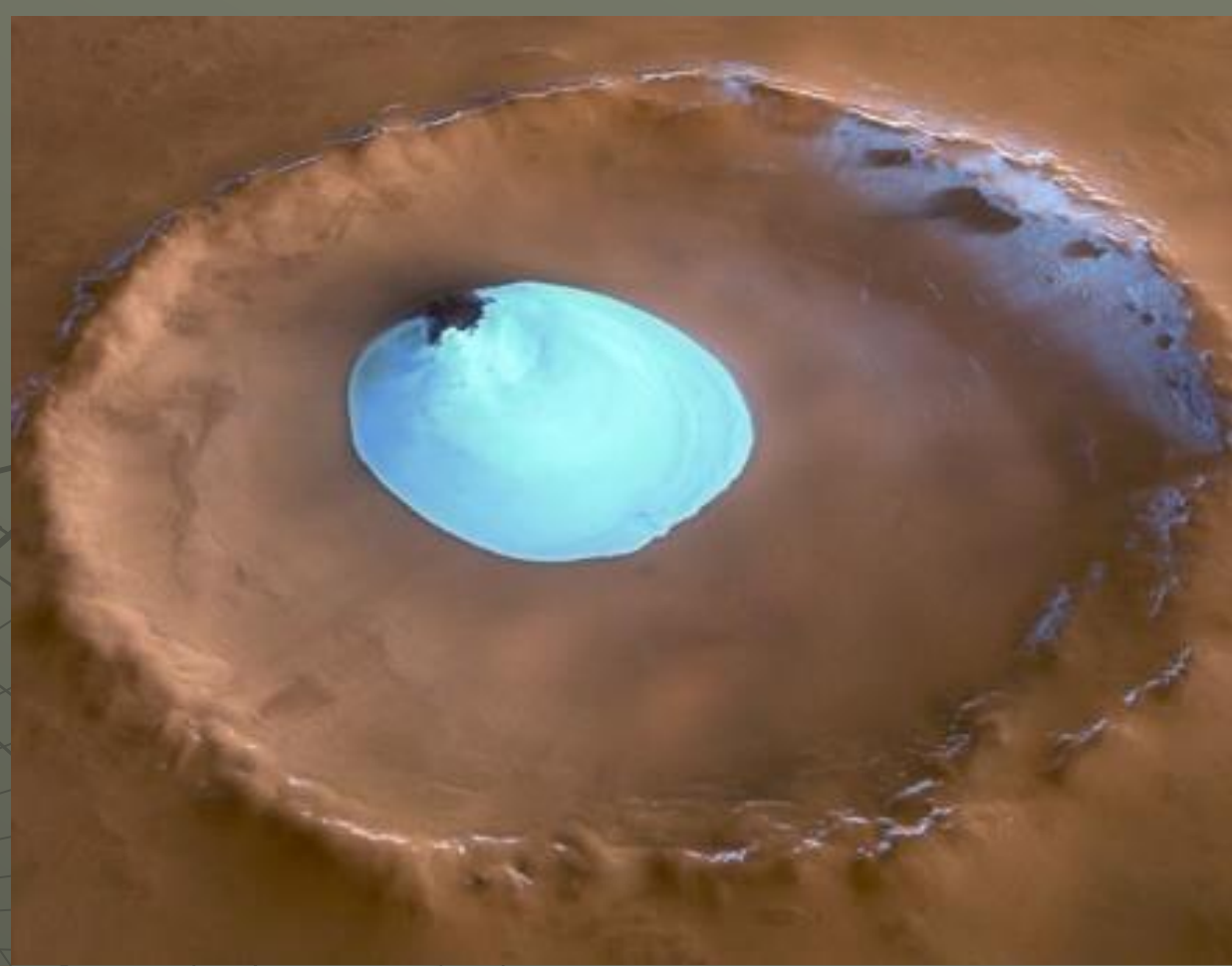
Mars

- Mass = $0.1 * M_{\text{earth}}$
- -50° C
- Very little atmosphere
- Thick crust = no plate tectonics
 - Mars cooled long ago
- Shows evidence of frozen water!



Sol 20

Sol 24

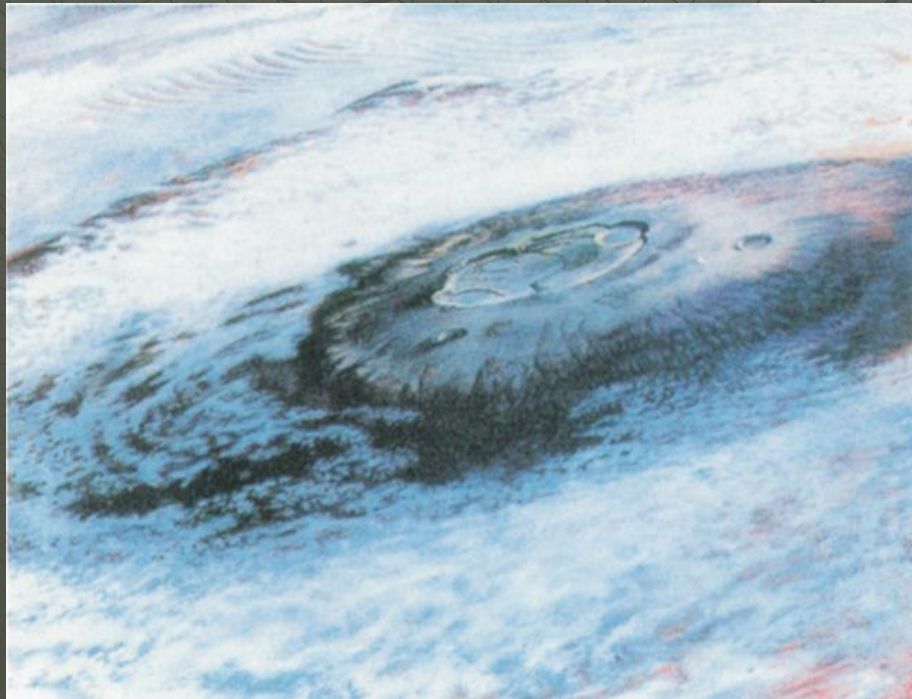


Mars: water evidence?

Really, Really Big Volcanoes

90,000 foot high
Olympus Mons
3*Mt Everest!

Mars' volcanoes on
map of US



TPS

- Of the following terrestrial bodies, where would you weigh the most?
 - A. Mercury
 - B. Venus
 - C. Mars
 - D. The moon

- What is the one commonality shared by all of the terrestrial planets?
 - A. They all have substantial atmospheres
 - B. They all have substantial magnetic fields
 - C. They all have rocky, metallic surfaces
 - D. They all have active volcanoes

- Rank the following planetary atmospheres from **thickest to thinnest**:
 - A. Earth, Venus, Mars, Mercury
 - B. Earth, Venus, Mercury, Mars
 - C. Venus, Mars, Earth, Mercury
 - D. Venus, Earth, Mars, Mercury

Jovian Planets

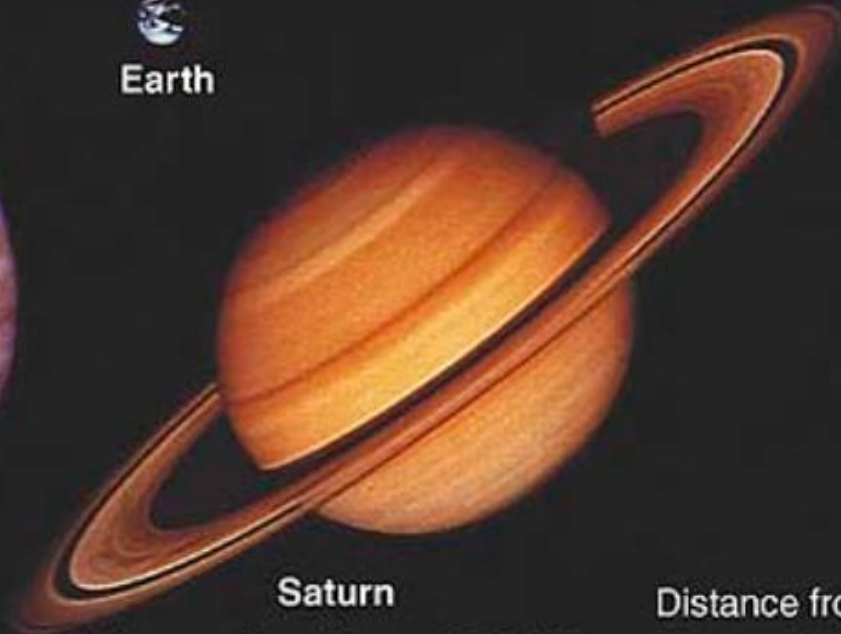


Earth



Jupiter

Distance from Sun = 5.20 AU
Mass = 318 M_{Earth}
Density = 1.33 g/cm³
Composition: mostly H, He



Saturn

Distance from Sun = 9.54 AU
Mass = 95 M_{Earth}
Density = 0.71 g/cm³
Composition: mostly H, He



Uranus

Distance from Sun = 19.2 AU
Mass = 14 M_{Earth}
Density = 1.24 g/cm³
Composition: H compounds,
rock, H and He



Neptune

Distance from Sun = 30.1 AU
Mass = 17 M_{Earth}
Density = 1.67 g/cm³
Composition: H compounds,
rock, H and He

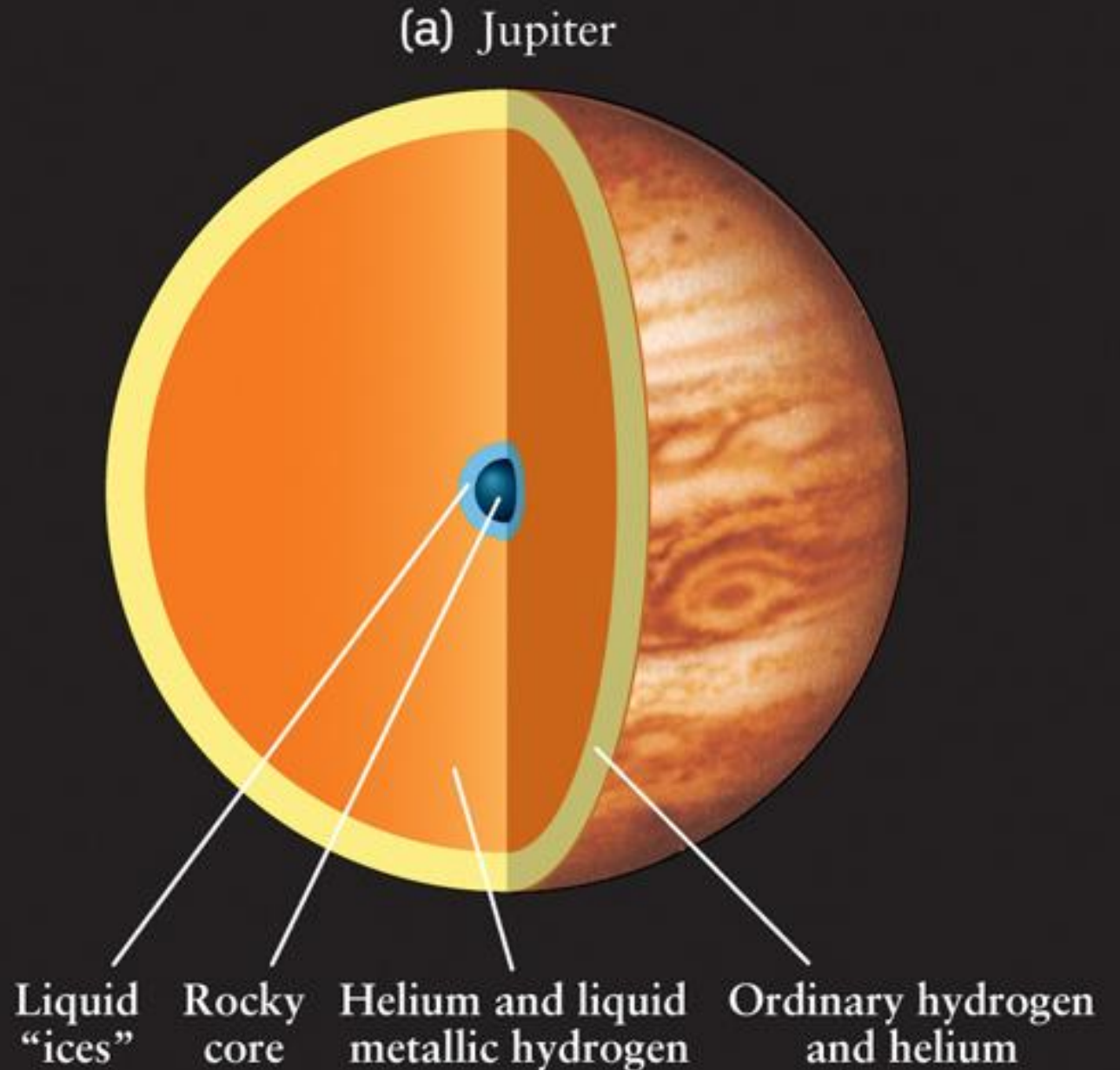
Jupiter

- ◆ Rotation Period: 9.9 hours
 - fastest rotating planet
- ◆ Similar in composition to sun ("failed star")
- ◆ More massive than all other planets combined
- ◆ Strongest planetary magnetic field
- ◆ 165° K



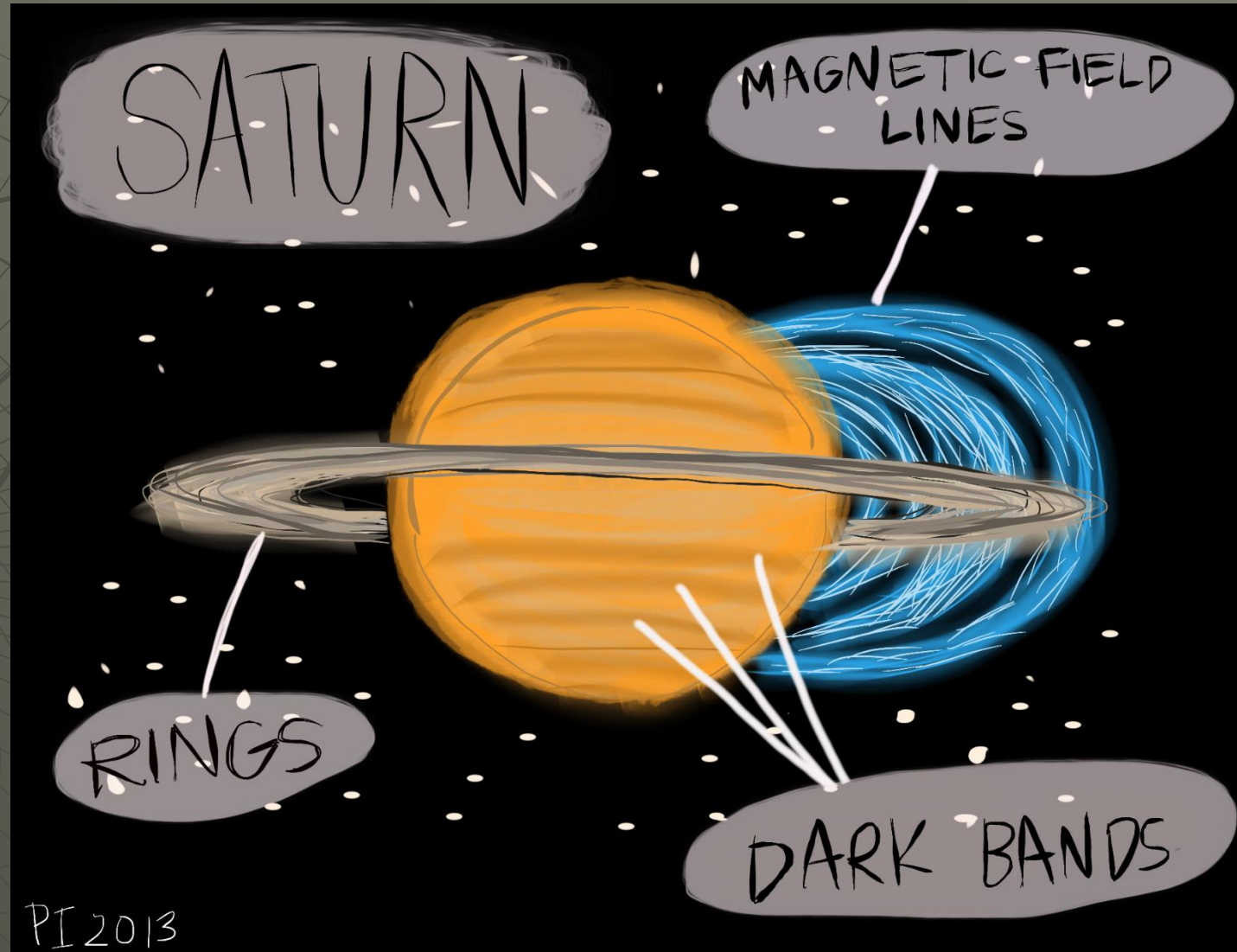
Interior

- Rocky core
 - 8 times mass of Earth
 - Crushed to the Earth's radius
- "liquid metallic hydrogen"
 - 1.4 million atmospheres!!!
- Rapid rotation + liquid metal hydrogen = large magnetic field



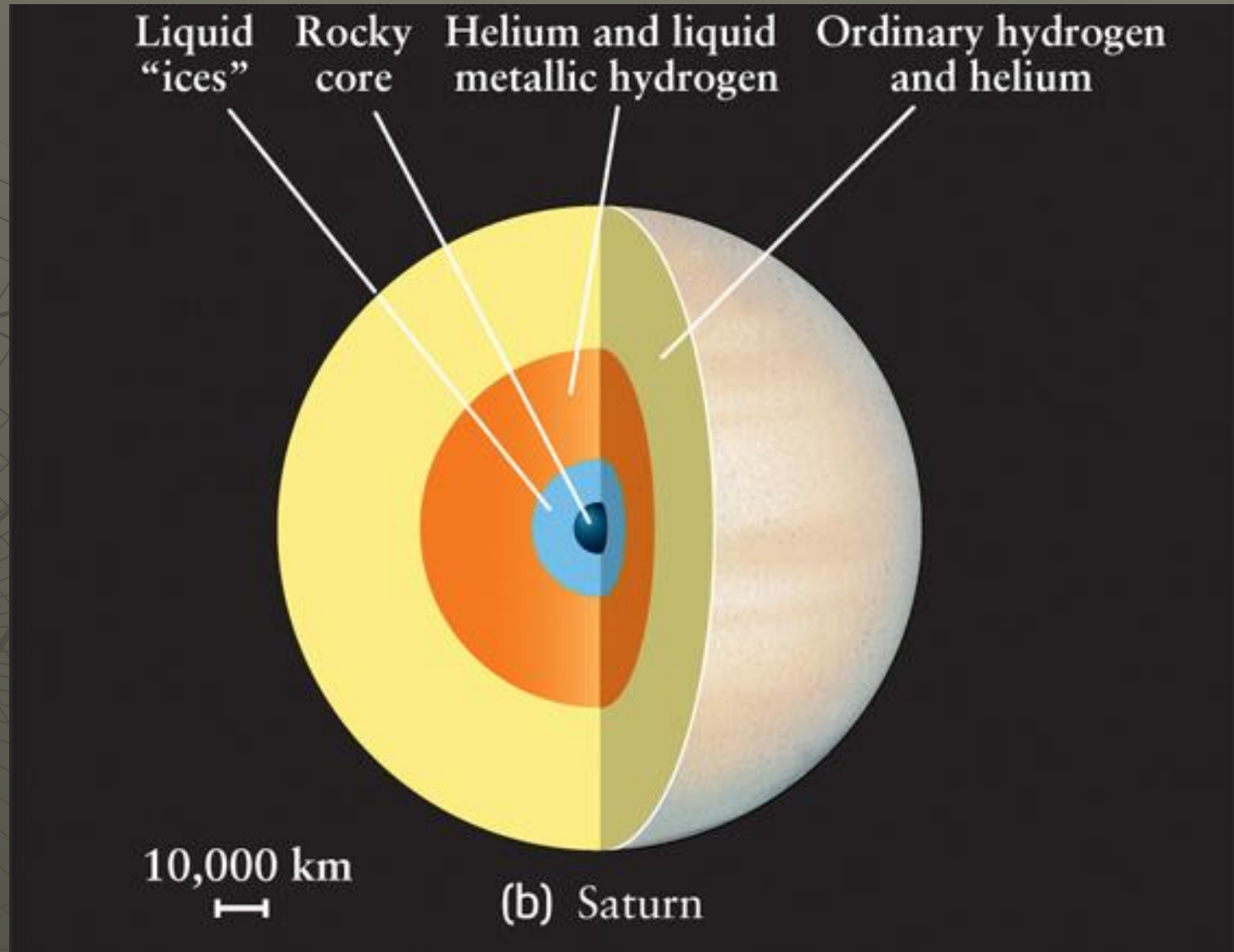
Saturn

- ◆ Very similar to Jupiter
- ◆ 93° K
- ◆ Rotates almost as fast:
 - 10.1 hours
- ◆ Similar composition to the Sun and Jupiter
- ◆ **Lowest density**
 - **Floats in water**



Interior

- Rocky core
- “liquid metallic hydrogen”
- Rapid rotation + liquid metal hydrogen = large magnetic field
 - Not quite as big as Jupiter



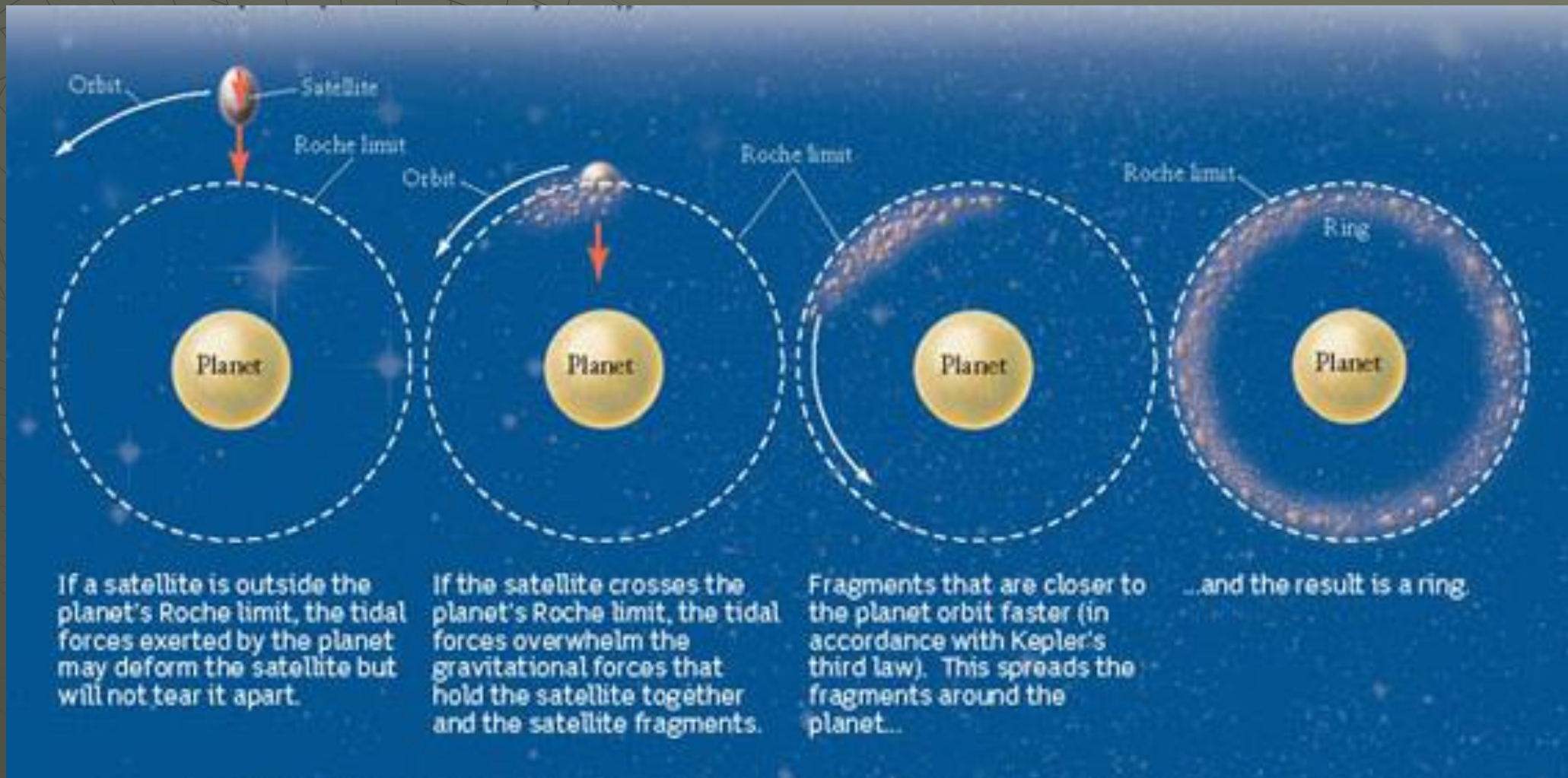
Rings: Saturn

- Hundreds of “ringlets”
- Cassini Division (dark gap) easily visible in backyard telescopes
- Why are there rings?
- Probably a moon that got too close!



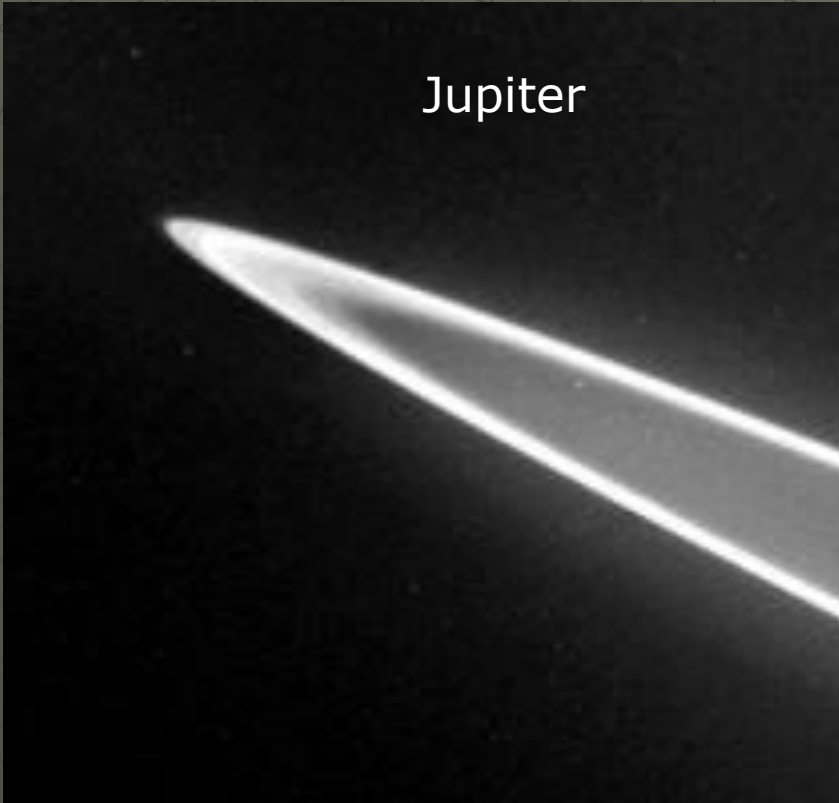
Where do Rings Come From?

Roche limit: the distance where tidal forces tear an object apart.

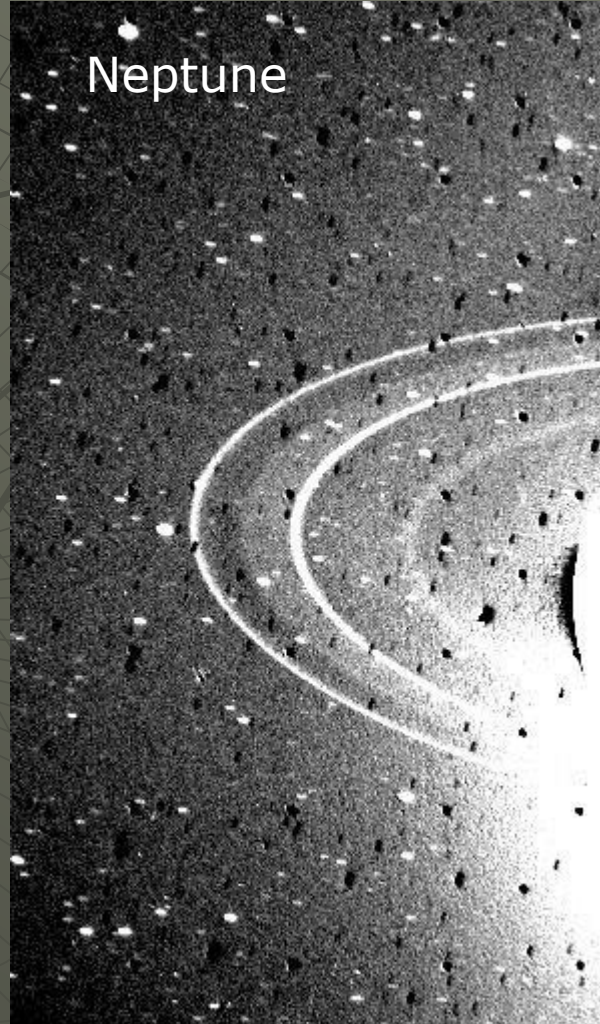


All Jovian Planets have Rings

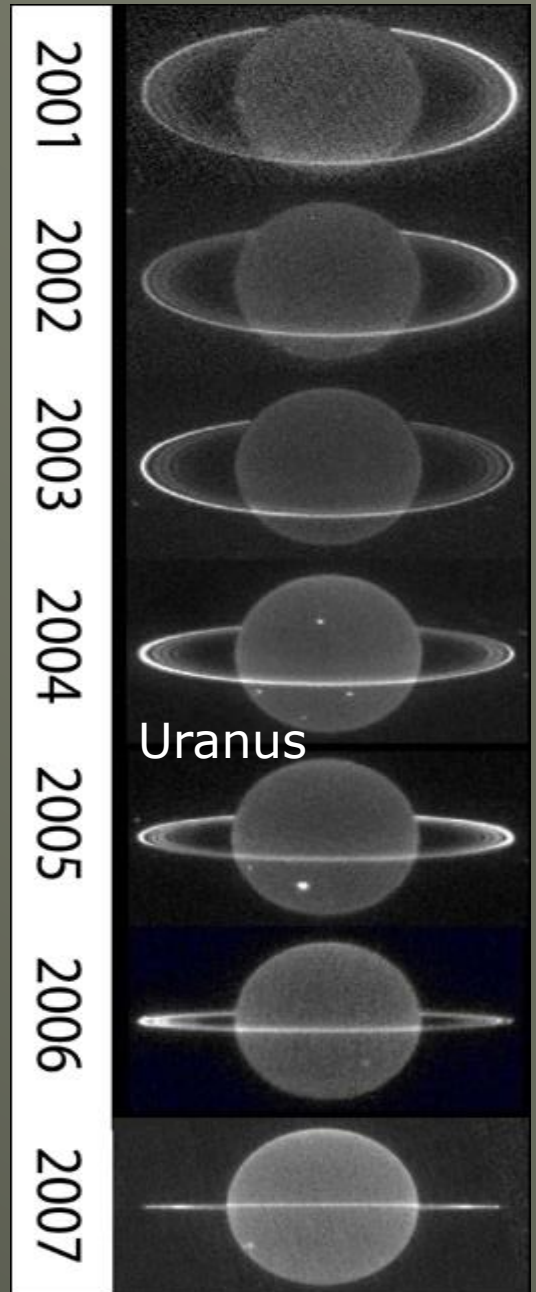
Jupiter



Neptune



Uranus



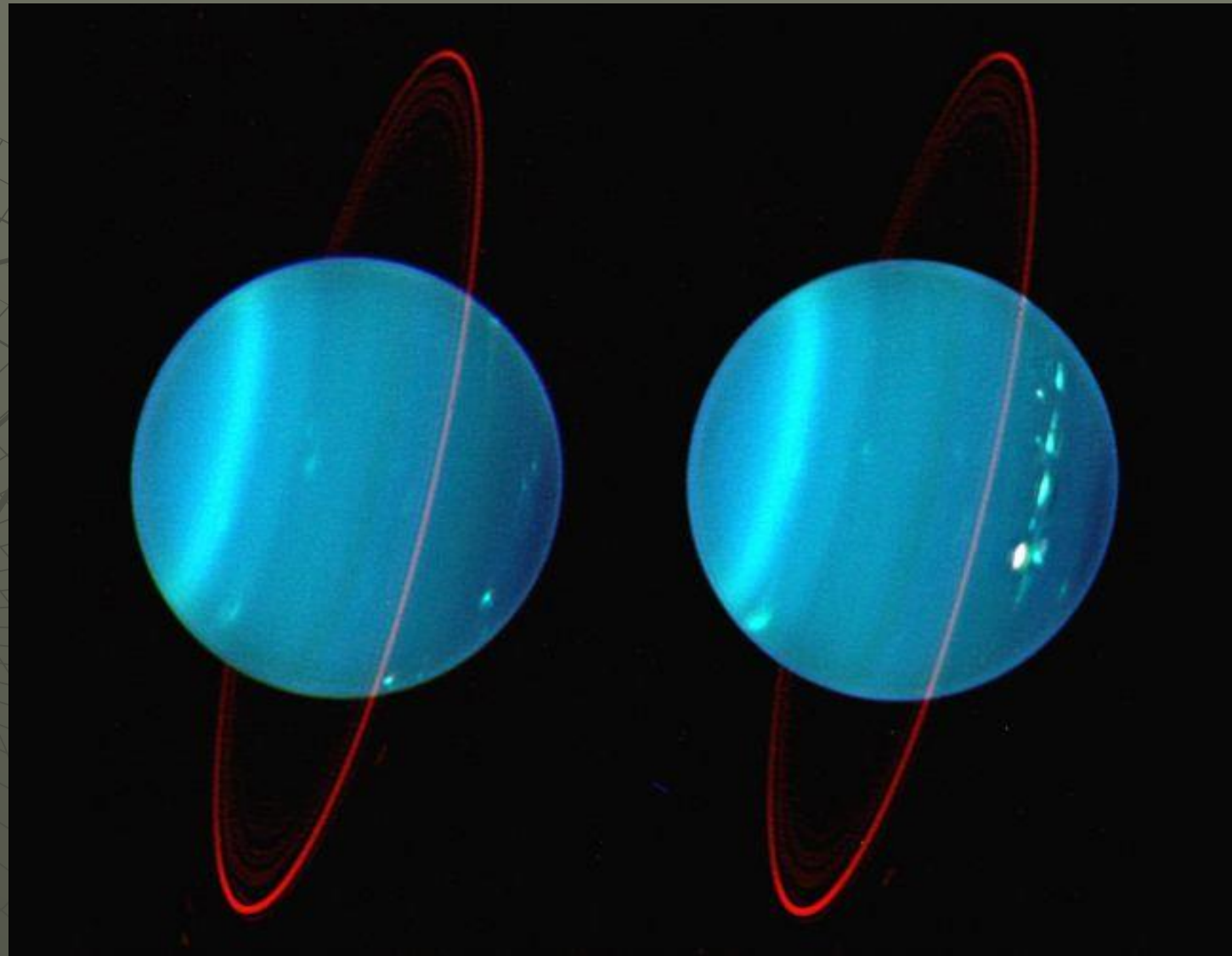
Uranus

[Uranus joke](#)

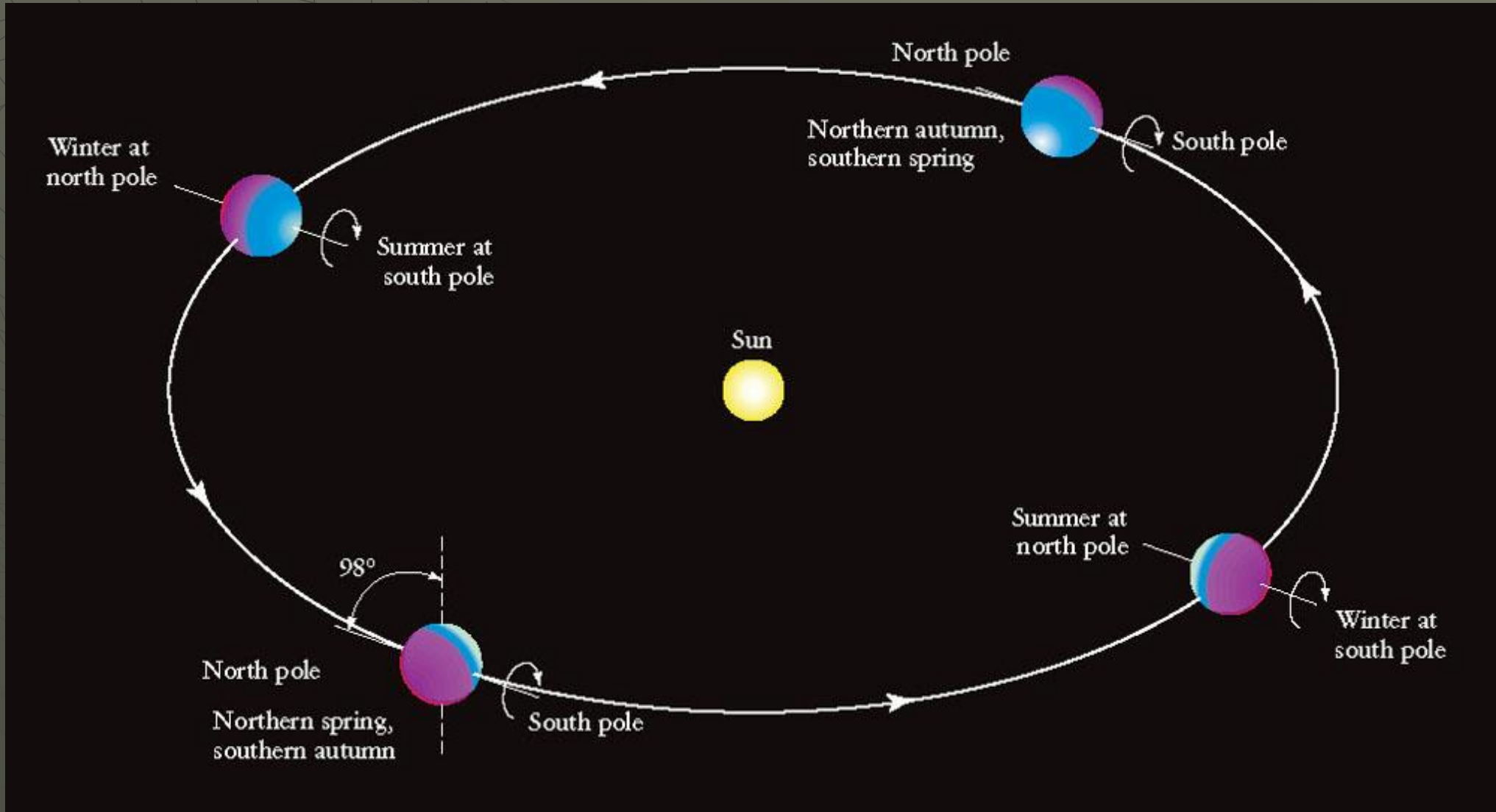


Uranus

- ◆ Similar composition to other Jovian planets
 - More Methane (3%)
 - Blue color
- ◆ Tilted about 90° on its axis (early collision?)
- ◆ 55° K

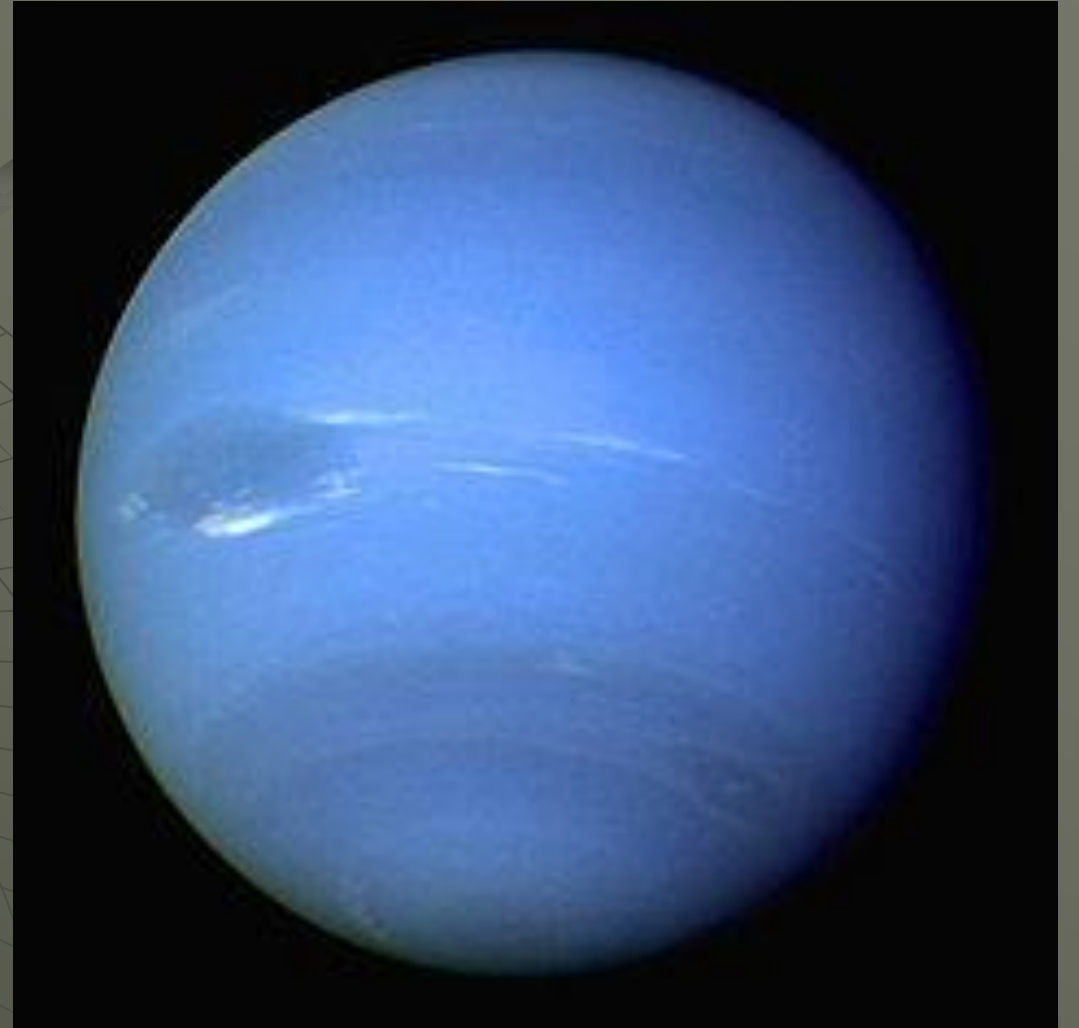


Uranus Orbit



Neptune

- ◆ Blue color due to methane gas (like Uranus)
- ◆ Fastest winds in solar system (1,500 mi/hour, windier than Laramie)
- ◆ 55° K; the same as Uranus?

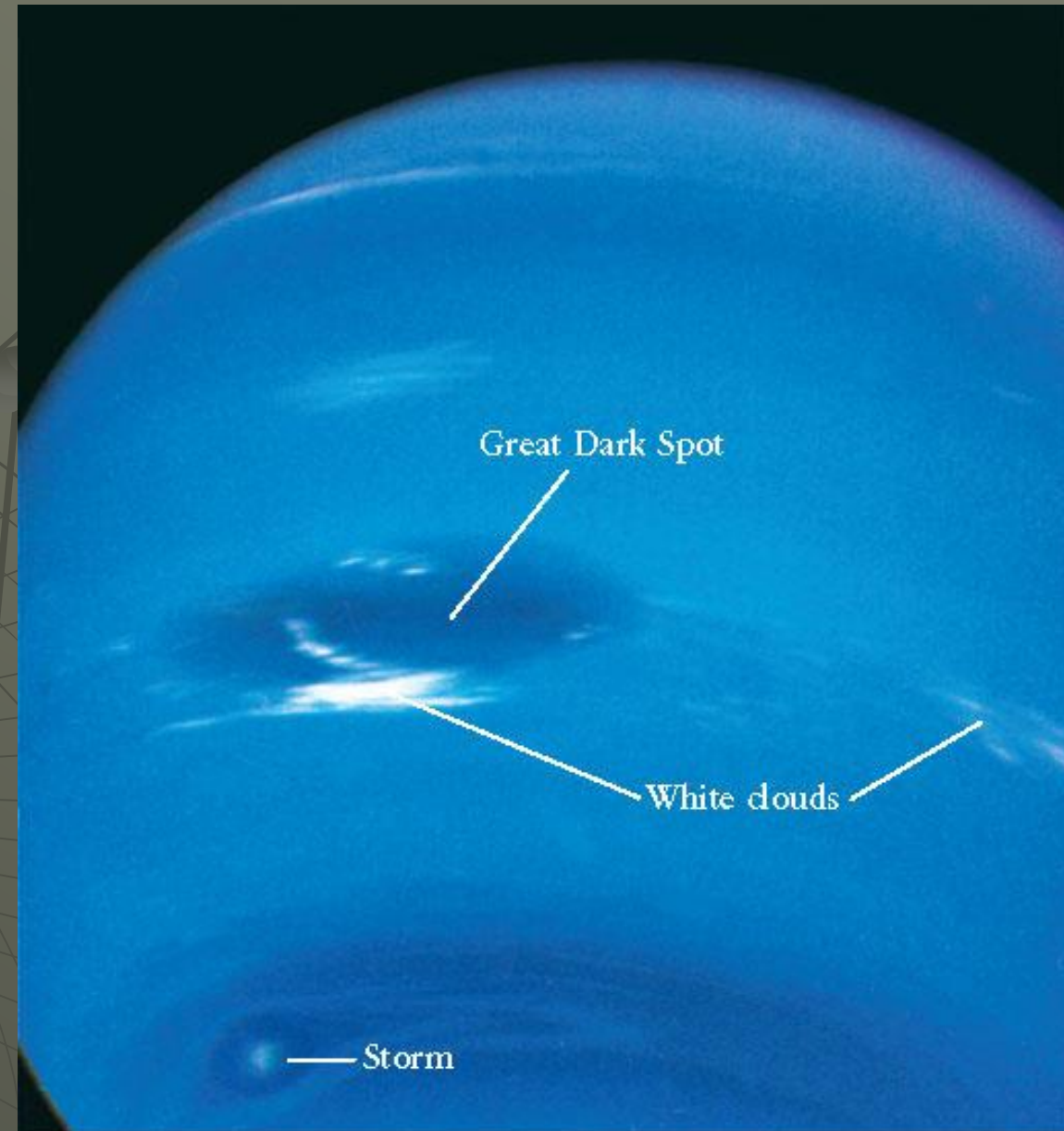
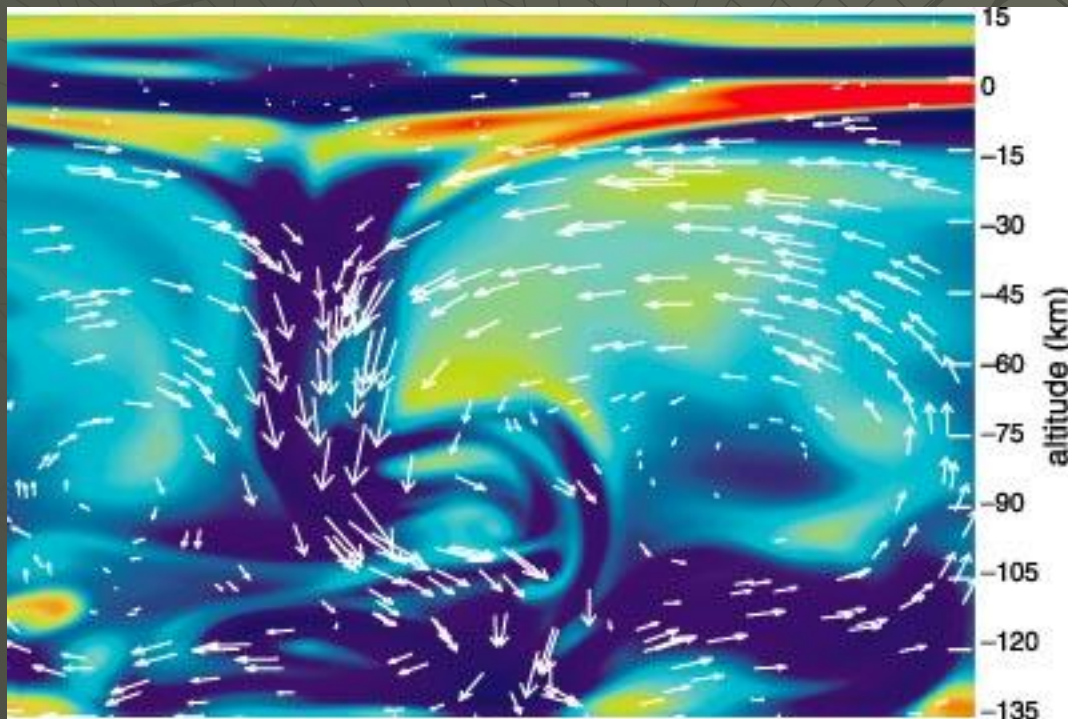


Internal Heating

- ◆ Receives half the light of Uranus
- ◆ But has the same Temp!
- ◆ **The planet is still contracting**
- ◆ Conservation of energy
 - Gravitational potential energy
 - converted to kinetic energy of gas
 - ◆ Thermal energy

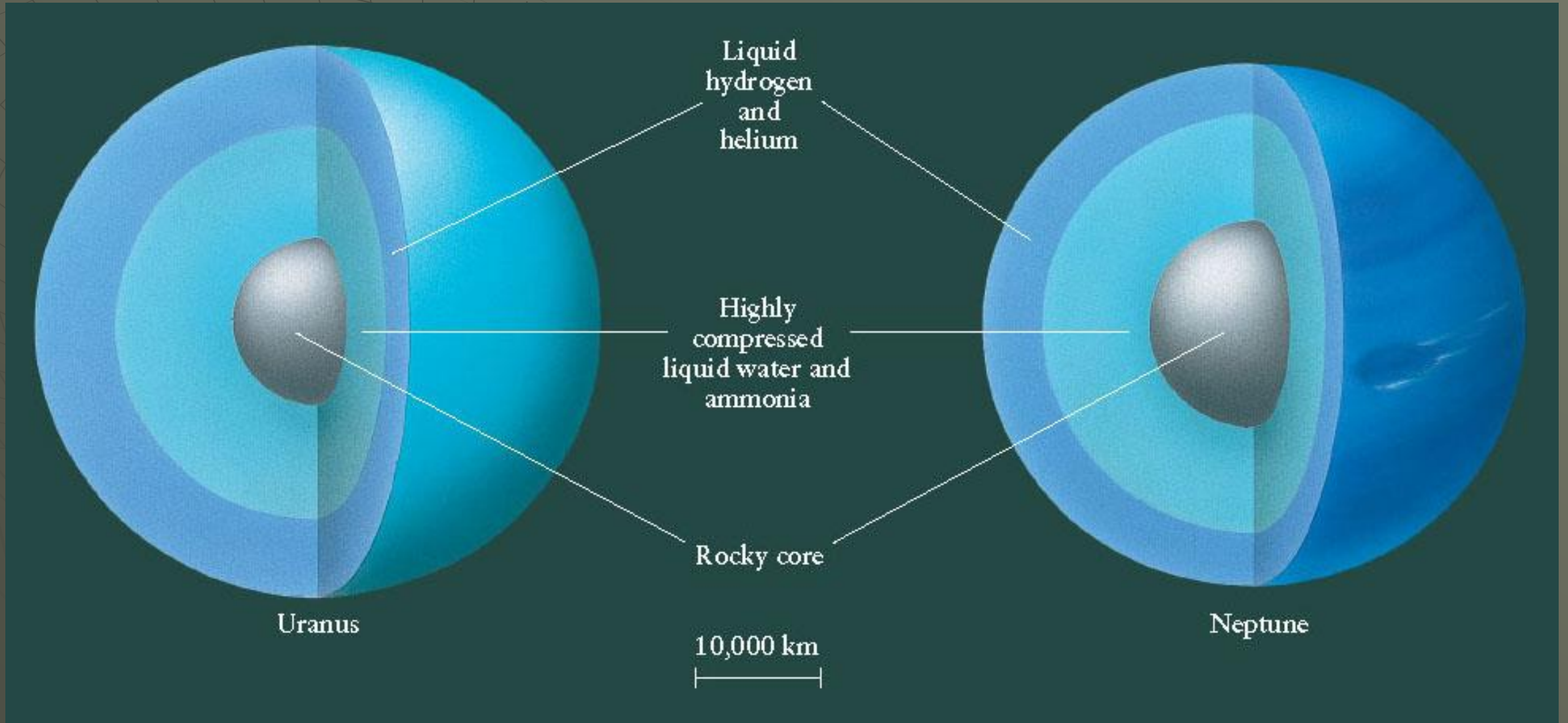
Uranus Storms

- ◆ Cold exterior (less Sun light)
- ◆ Internal heating (contraction)
- ◆ **Convection storms!!!**



Uranus & Neptune Interior

How do these exist out here!?!?!?



- ◆ As a large moon crosses a planet's Roche limit, it will
 - A. change color.
 - B. break into smaller pieces.
 - C. develop a magnetic field.
 - D. flatten into a disk.

- ◆ The fact that Uranus and Neptune have the same surface temperature, despite Neptune being twice as far from the Sun, suggests that
 - A. Neptune is denser than Uranus.
 - B. winds are stronger on Neptune.
 - C. Neptune has an internal heat source.
 - D. Neptune has a stronger magnetic field than Uranus.