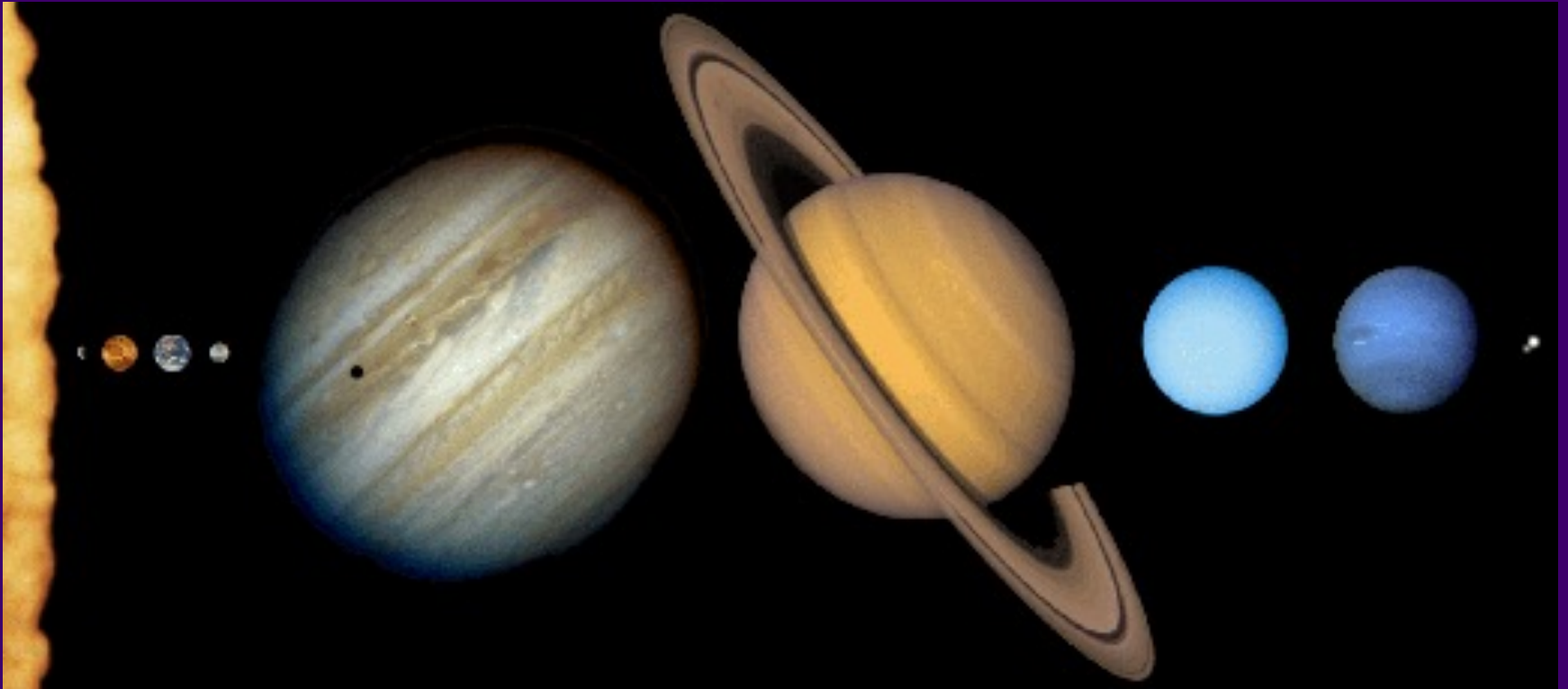


The Jovian Planets

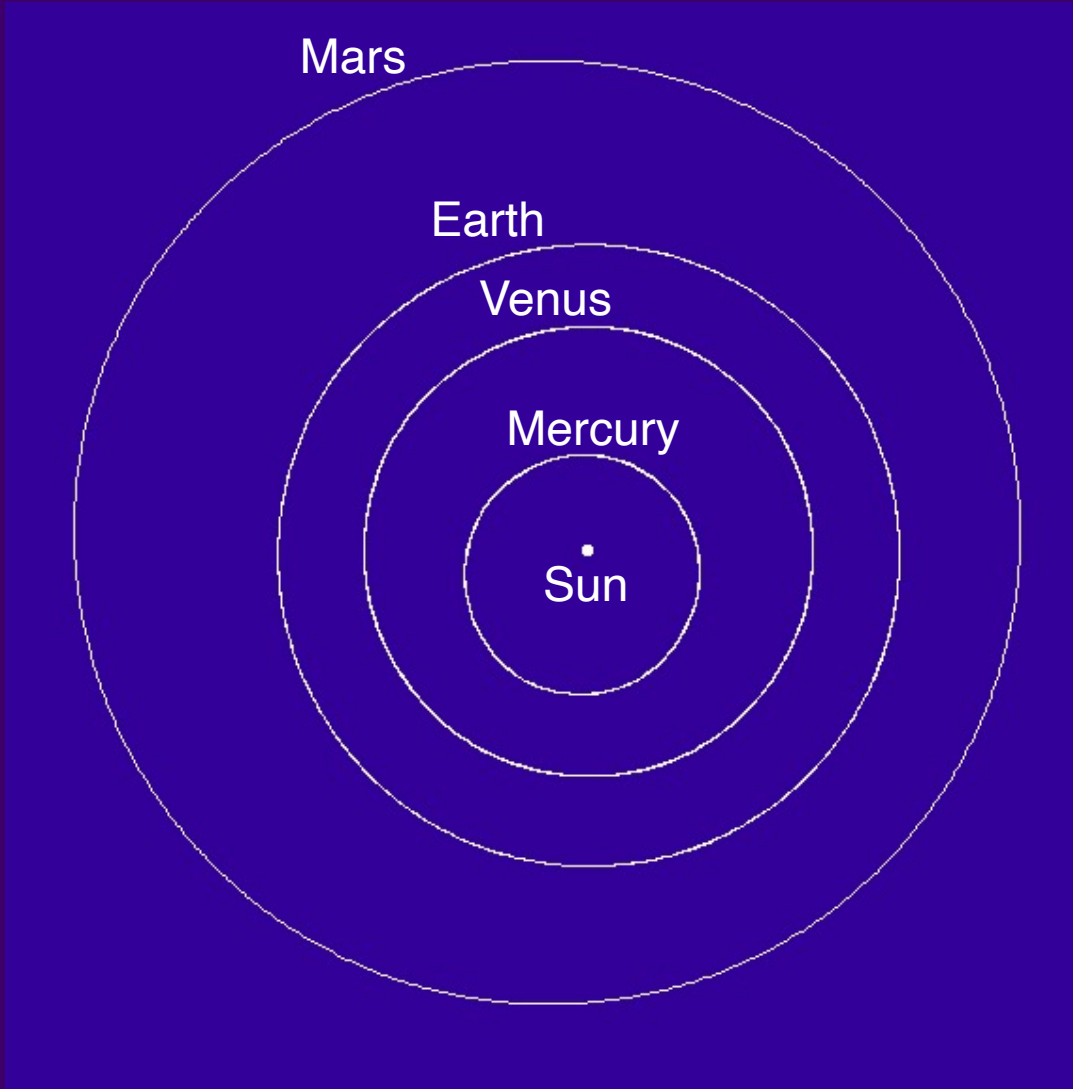
Today:

- Tour of the four giant planets (Jupiter, Saturn, Uranus, Neptune) and their moons
- Sizes, masses, temperatures, composition, chance of life?
- Robotic exploration

The planets, to scale



The Inner Solar System



On this scale:

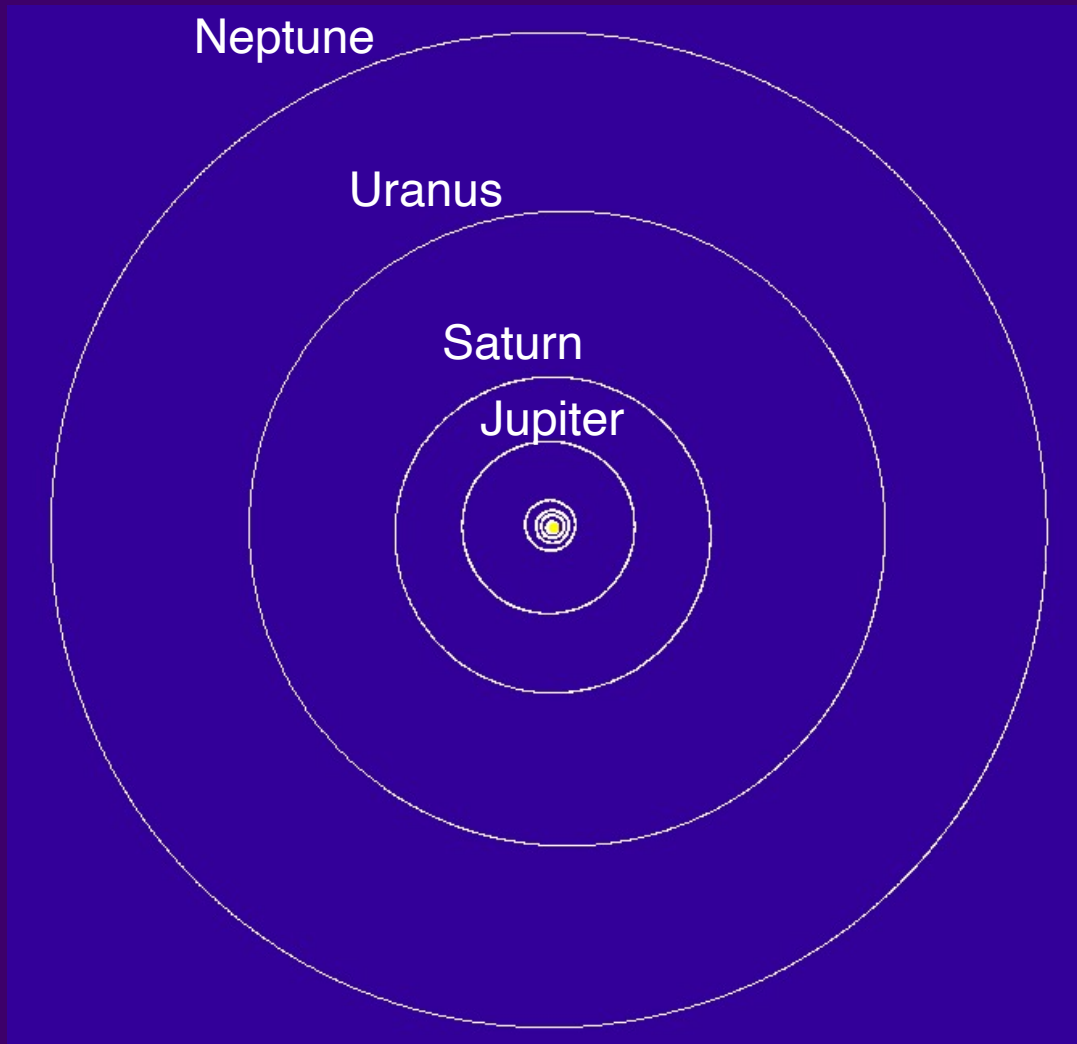
1 A.U. = 120 pixels

Diam. of Sun = 1 pixel

Diam. of moon's orbit =
1/2 pixel

Diam. of earth = 1/100
pixel

The Outer Solar System



On this scale:

1 A.U. = 7 pixels

Orbital radii:

Jupiter 5.2 A.U.

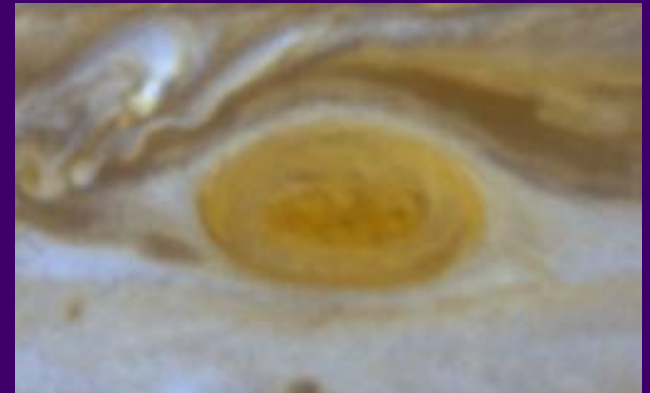
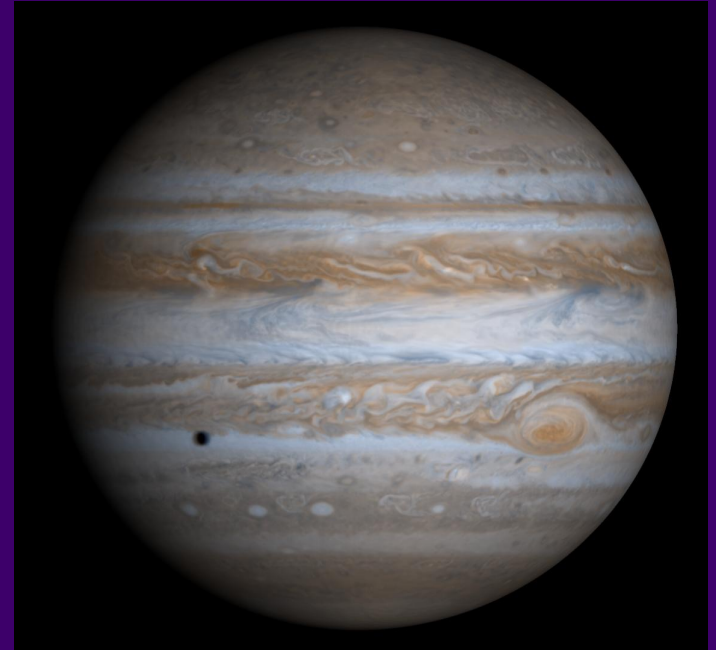
Saturn 9.5 A.U.

Uranus 19 A.U.

Neptune 30 A.U.

Jupiter

- 11 times earth's diameter (1/10 sun's diameter)
- 300 times earth's mass (1/1000 sun's mass)
- Visible surface is gas (mostly hydrogen); interior must be mostly liquid, with solid core
- Fascinating banded patterns, hurricanes, great red spot
- Four large moons, many small ones
- Visited briefly 4 times in 1970's (Pioneer, Voyager); orbited by Galileo spacecraft 1995-2003

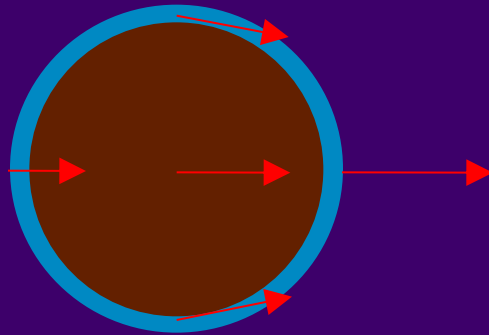


Moons of Jupiter

- Io: VERY volcanically active, covered with sulfur
- Europa: Covered with ice, with liquid ocean underneath
- Ganymede: Bigger than Mercury, icy and cratered
- Callisto: Also big, icy, cratered
- Many smaller moons (basically chunks of rock)

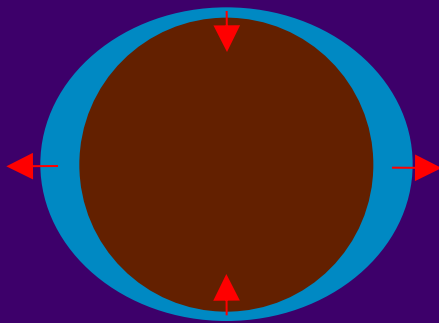


Tidal Forces



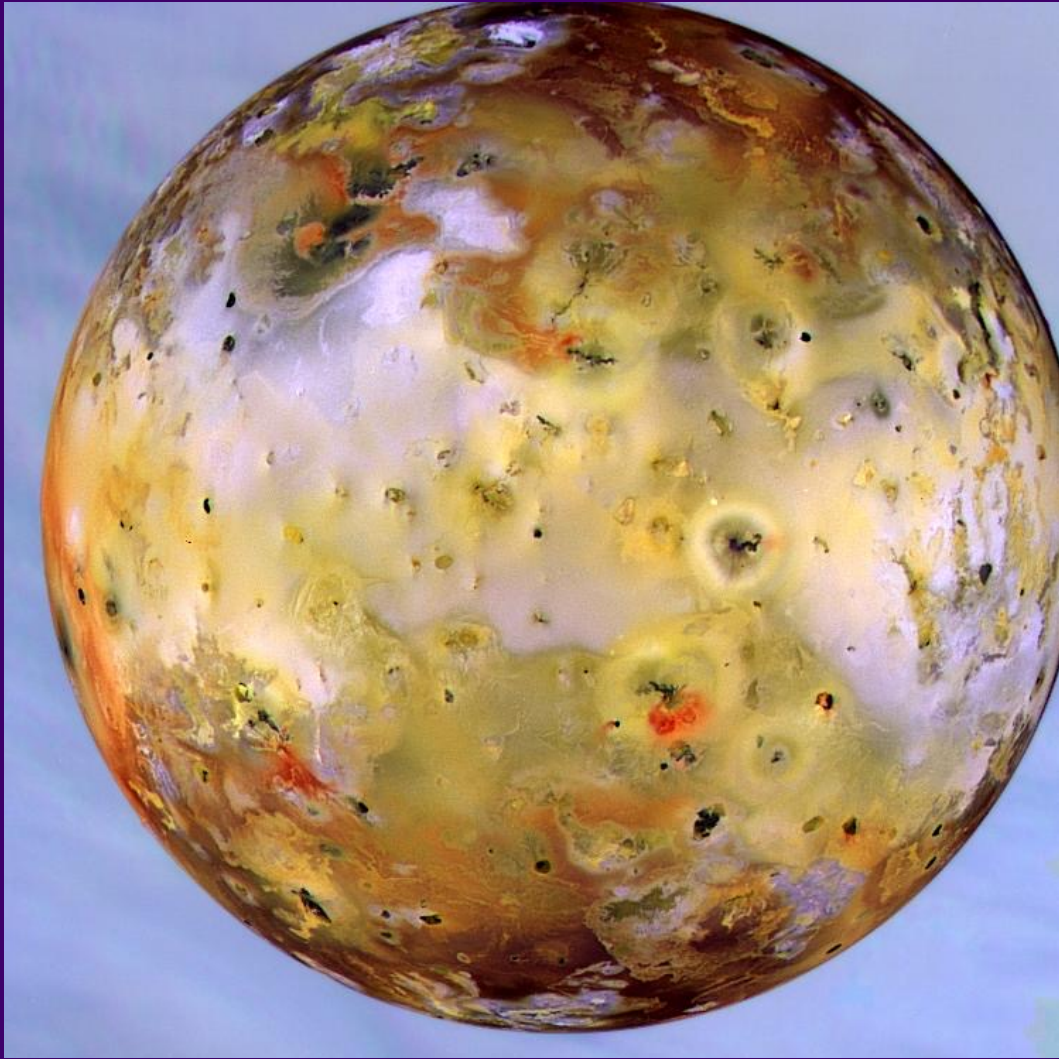
Moon

Different parts of earth feel slightly different pulls toward moon.

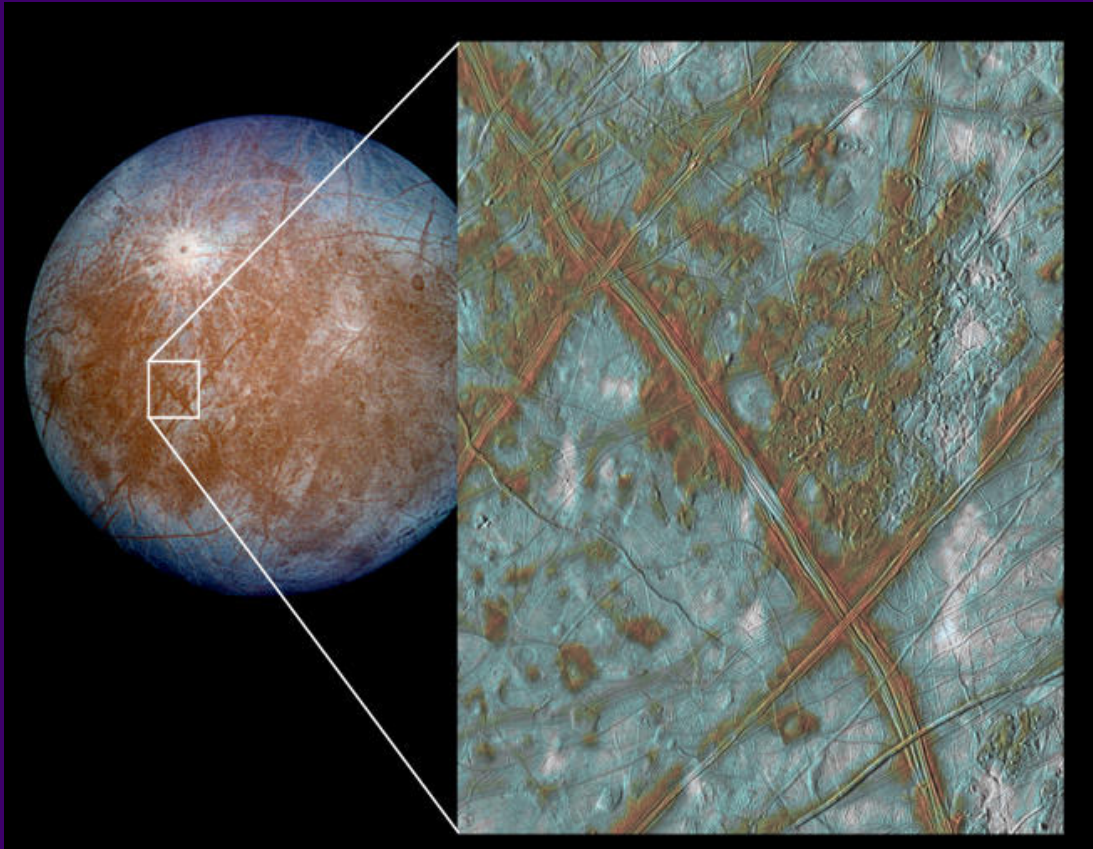


Relative to earth's center, 2 sides are pulled away and rest is pushed in.

Io: Heated by tidal friction



Europa: Water beneath ice



Water is probably kept warm by tidal friction.

Could this be a place to look for life?

Moons of Jupiter

Io



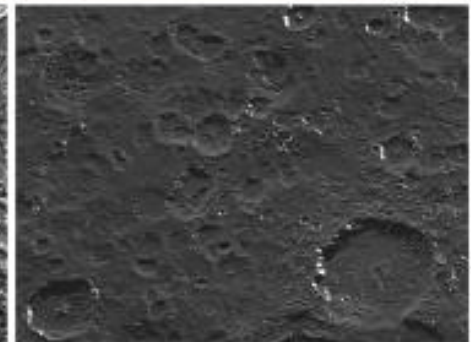
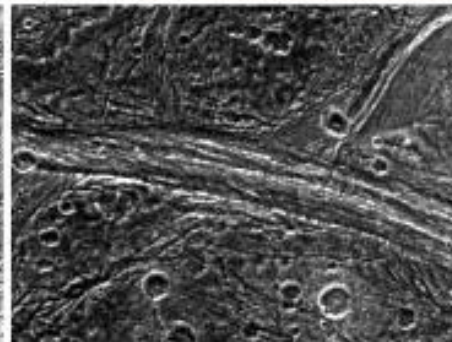
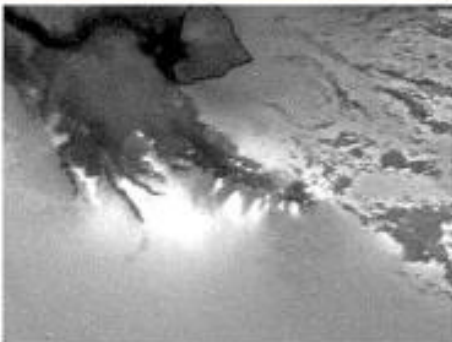
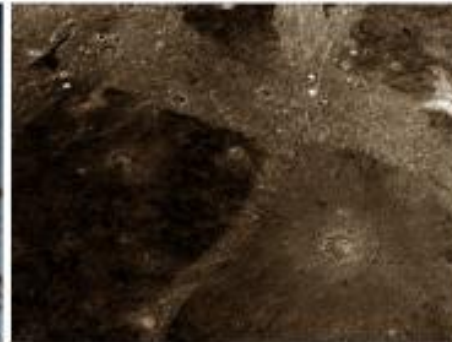
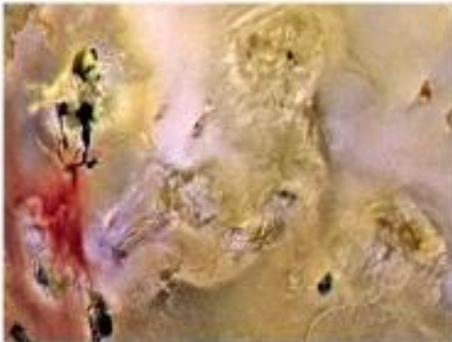
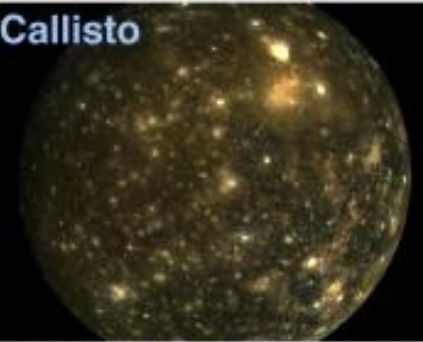
Europa



Ganymede

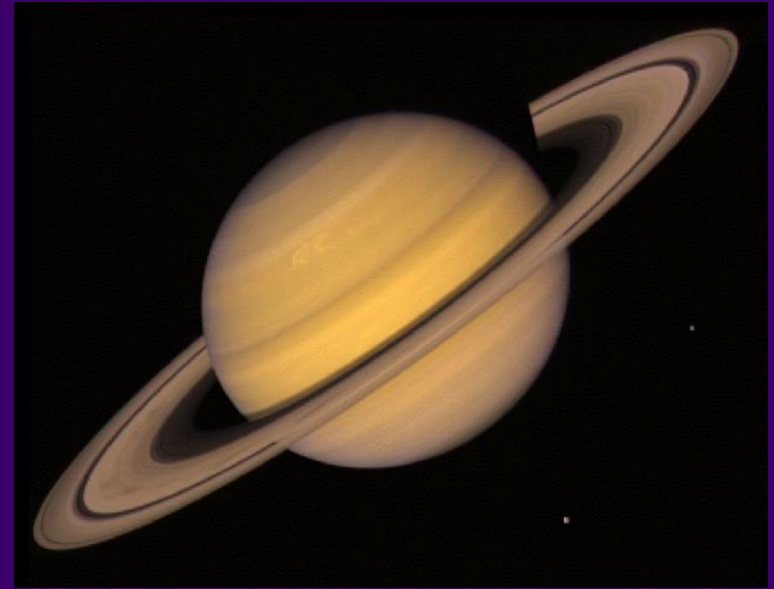


Callisto

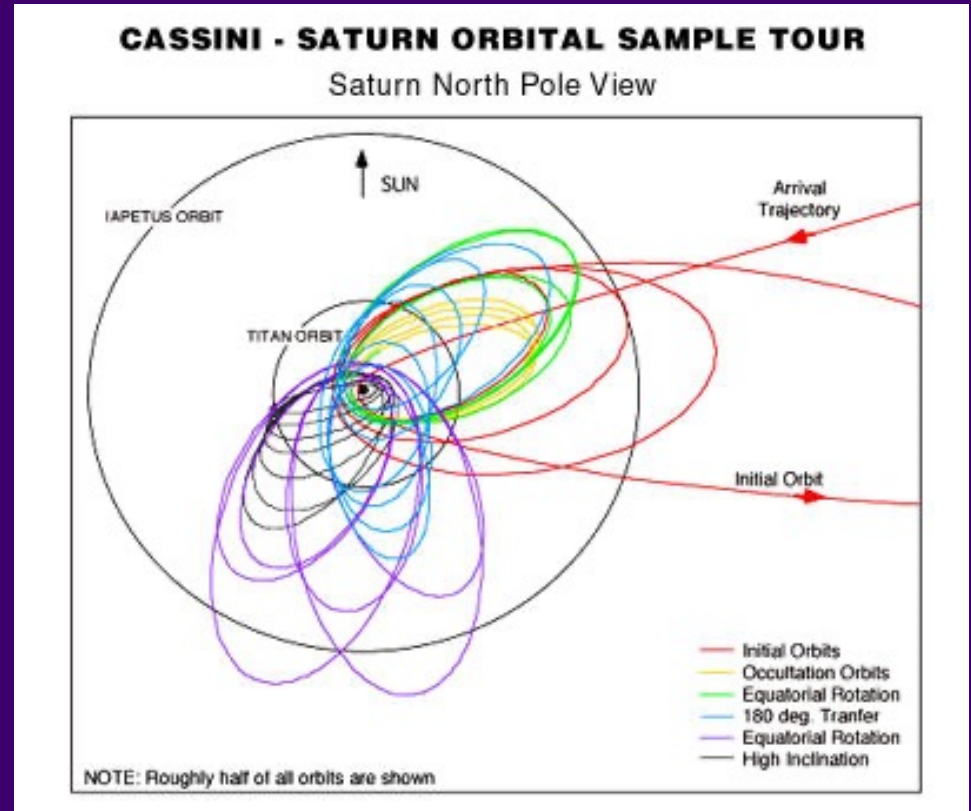


Saturn

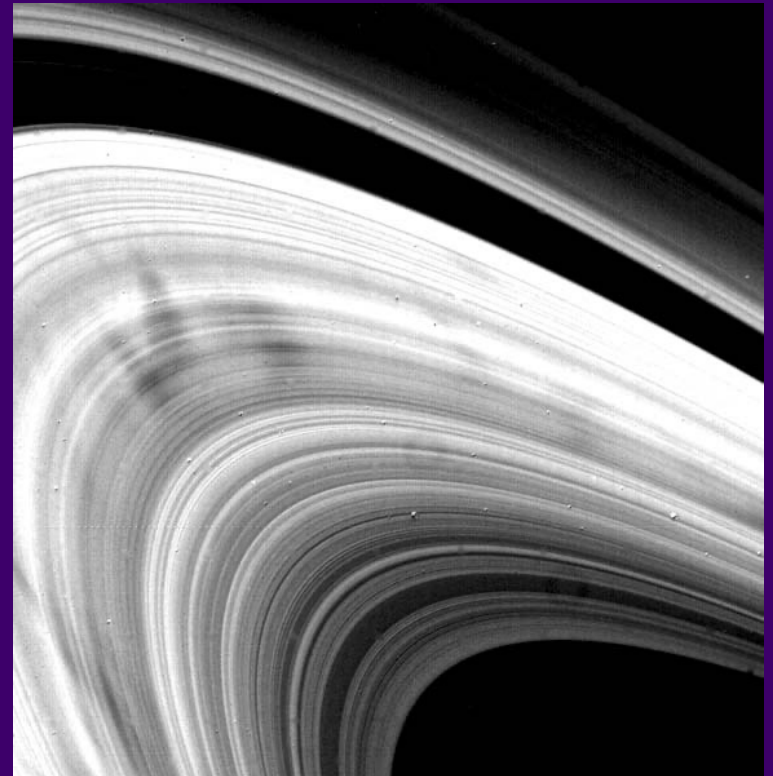
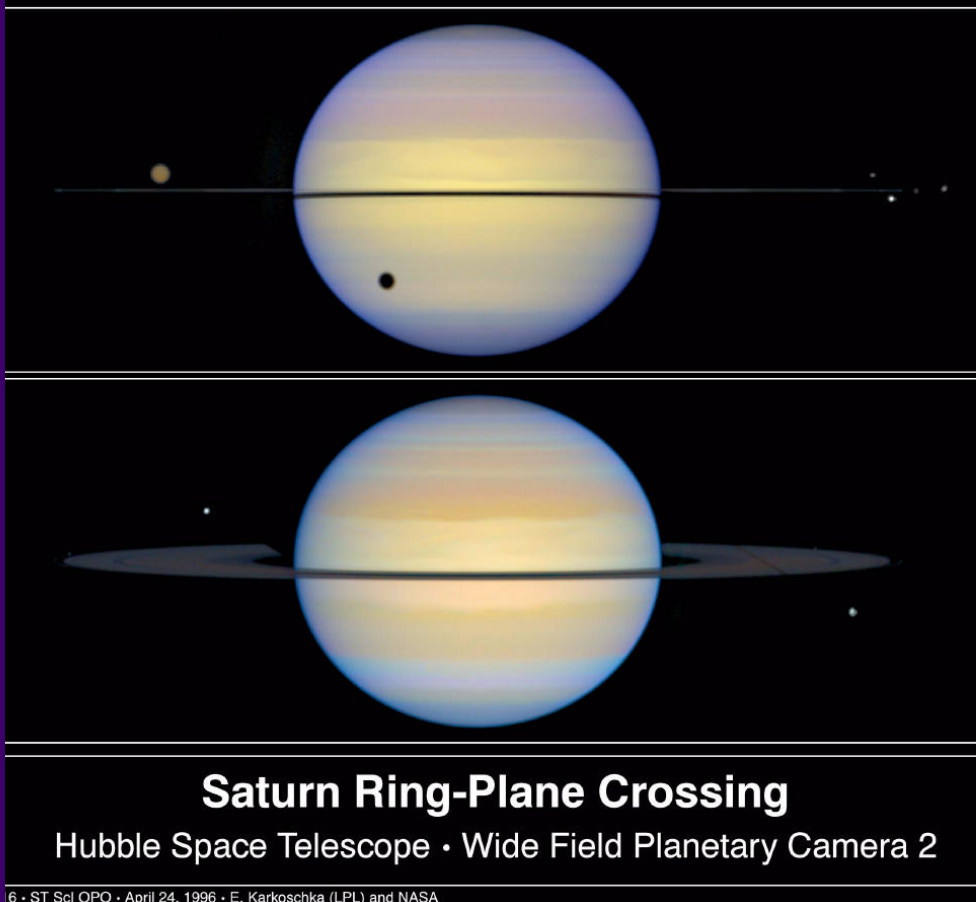
- Prettiest planet in small telescopes
- 9 times earth's diameter
- 100 times earth's mass (1/3 Jupiter)
- Gaseous surface, liquid interior, solid core (like Jupiter)
- Rings!
- Many moons
- Visited by Pioneer 11 (1979), Voyager 1 & 2 (1980-81); Cassini currently in orbit, 4-year mission



Cassini Mission

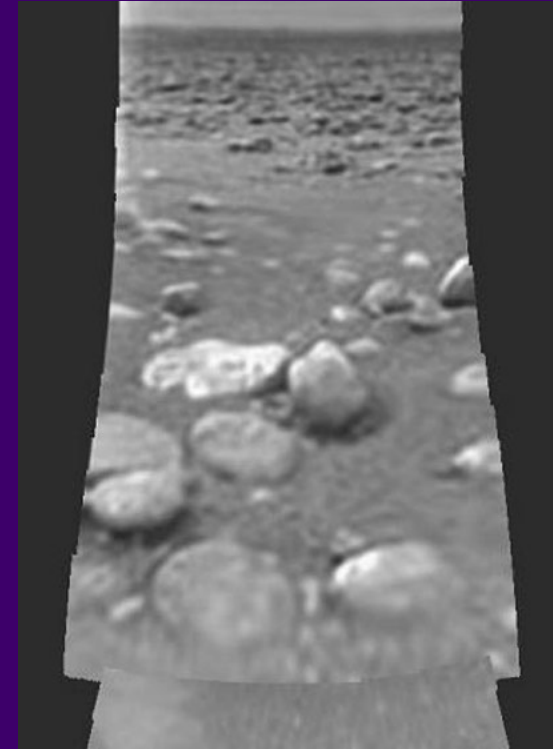
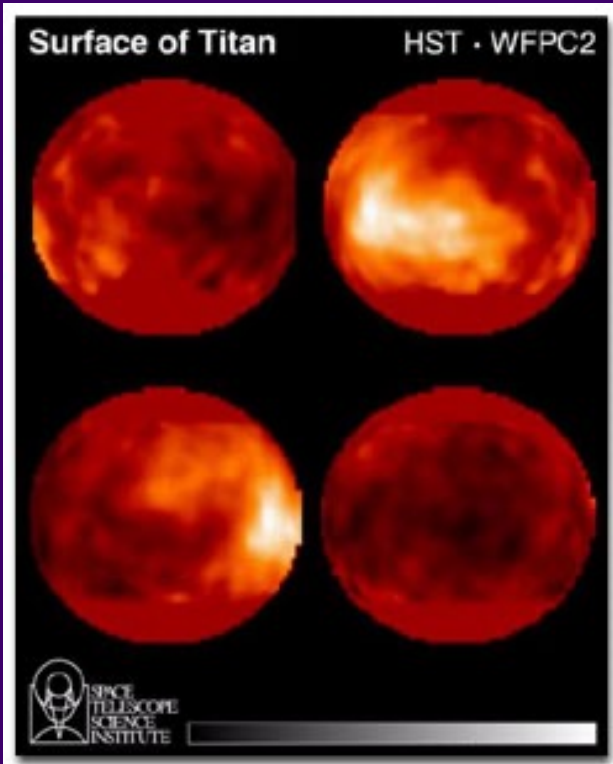


Saturn's rings



Rings are mostly ice particles, from tiny grains to boulder-sized chunks. Gaps are created by tug of nearby moons.

Titan (Saturn's largest moon)



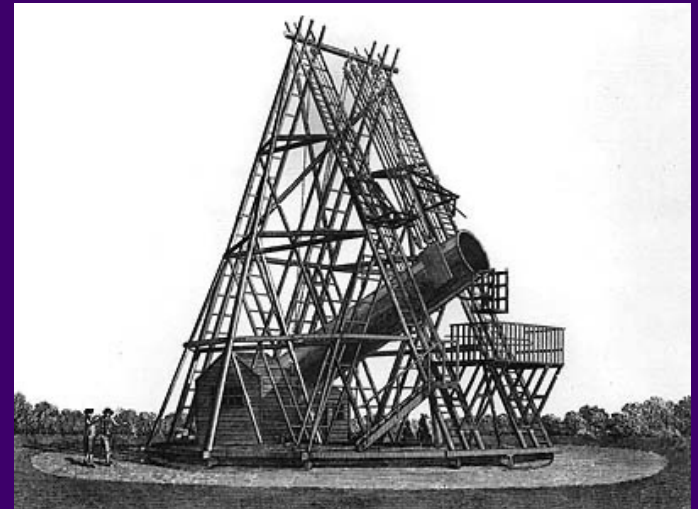
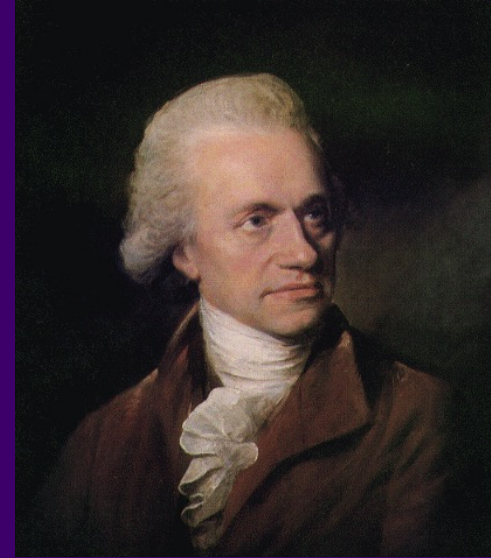
Opaque atmosphere of nitrogen, methane, smog.
Surface (cold!) could have liquid methane, other hydrocarbons. Huygens probe landed in Jan. 2005.

Saturn's other moons...



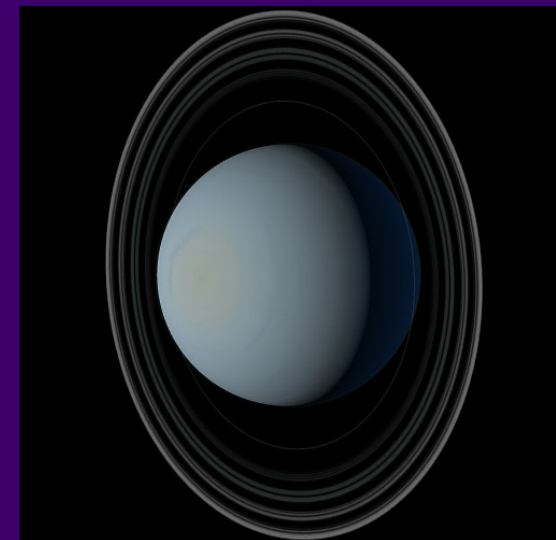
Uranus

- Discovered by William Herschel, 1781
- At the threshold of naked-eye visibility
- Less than half the size of Saturn, and nearly twice as far
- Another gas giant planet with rings (faint), many moons
- Spin axis is tipped sideways
- Visited by Voyager 2, 1986



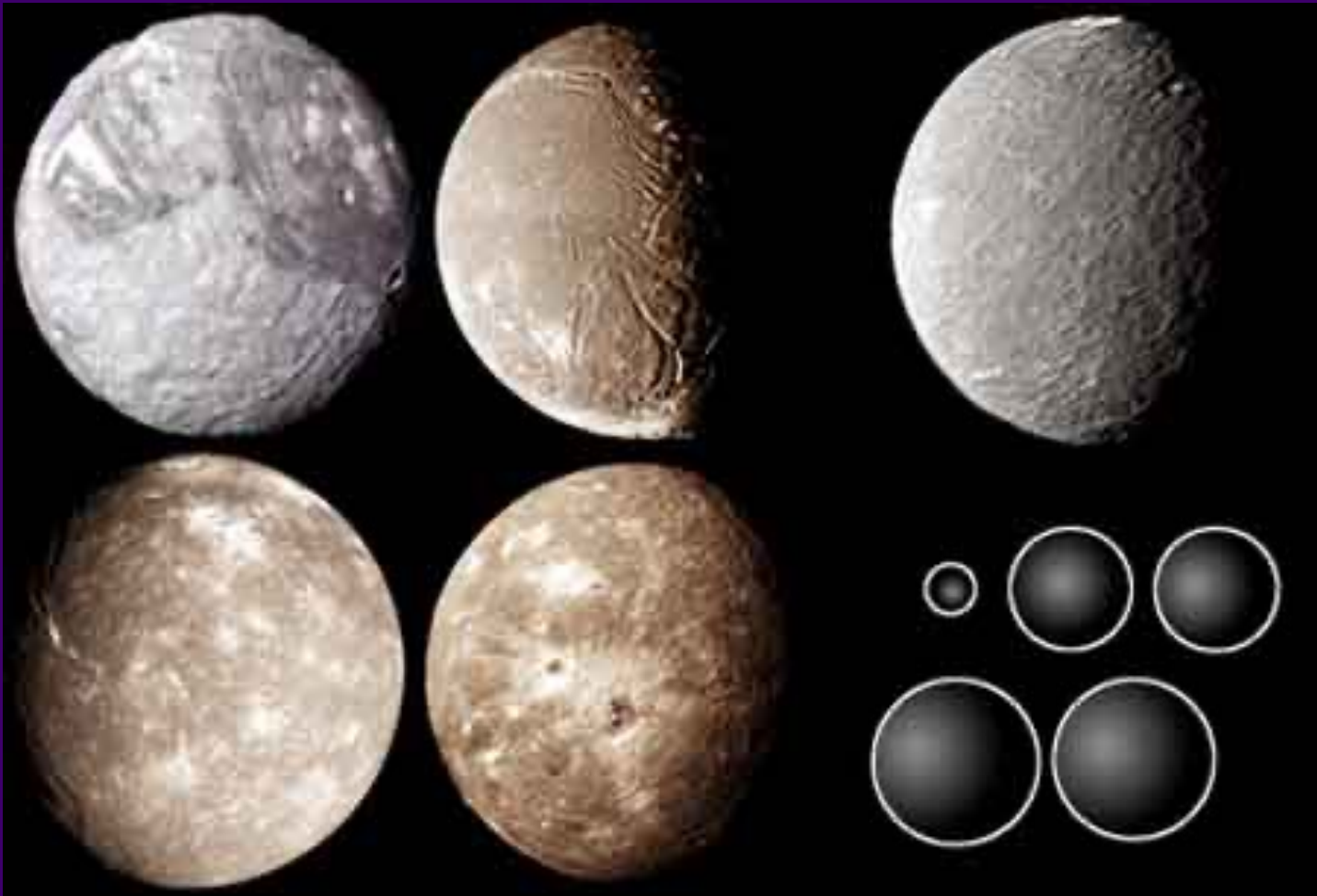
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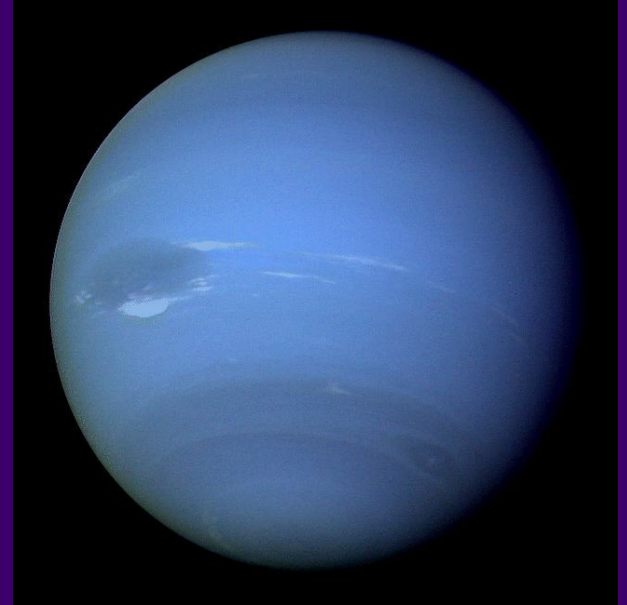
Moons of Uranus

All are icy, smaller than our own moon.



Neptune

- Discovered by mathematics (anomaly in orbit of Uranus) in 1845-46, by John C. Adams and Urbain Leverrier
- Can be seen in binoculars (looks like a faint star)
- About the same size as Uranus, but 60% farther away
- Voyager 2 discovered a cool blue spot, which has since disappeared
- Largest moon, Triton, is a little smaller than our own and orbits backwards; surface is covered with ice



The Terrestrial Worlds

