

Lesson 12

Uranus & Neptune

Uranus

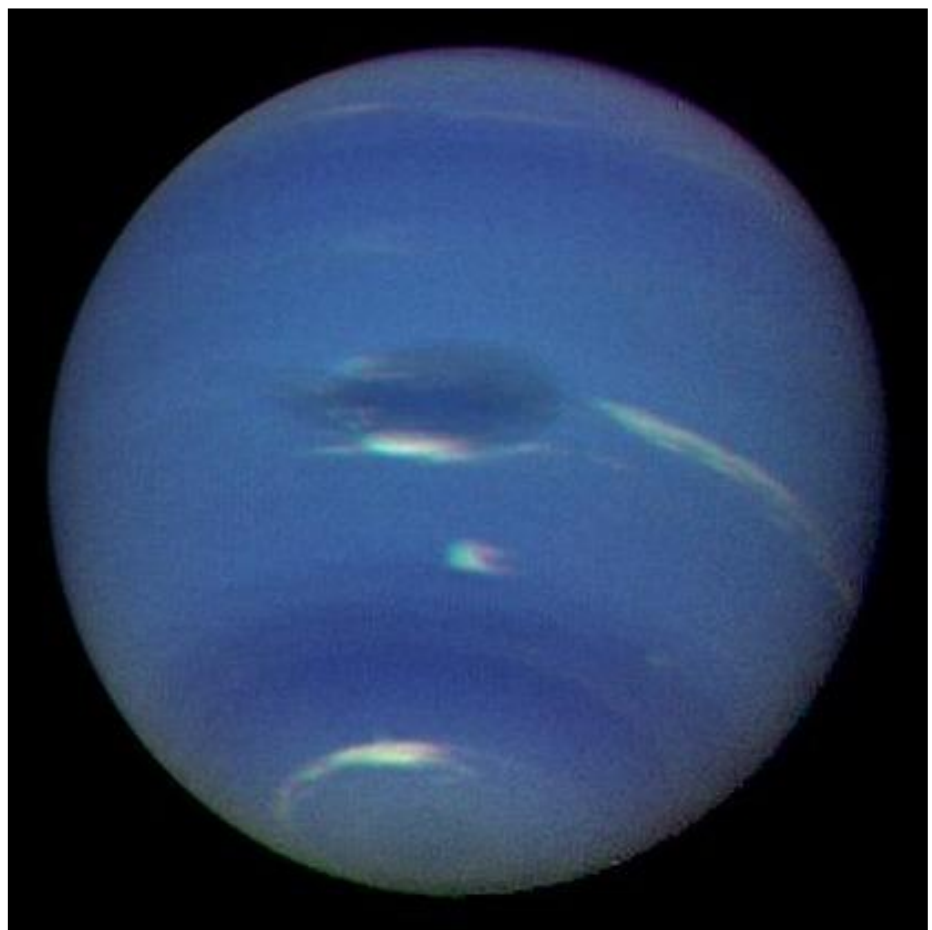
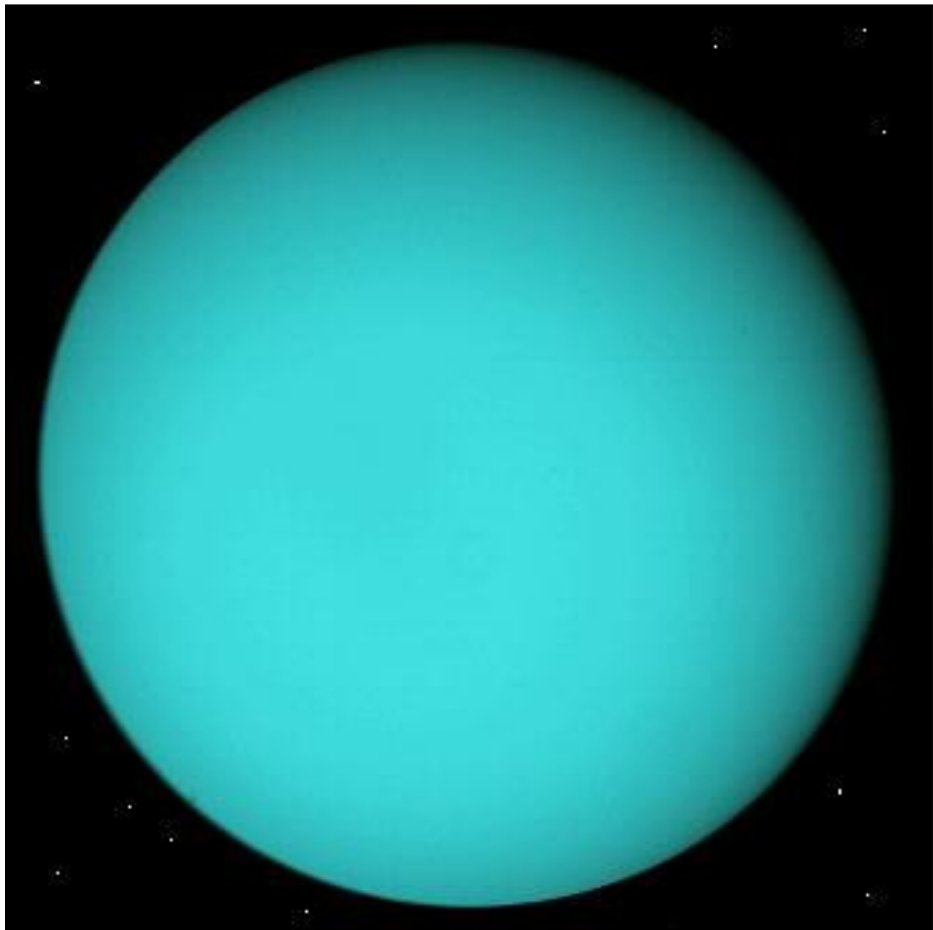
- Seventh planet from the sun.
- Equatorial diameter = 5.11×10^4 km
- Planetary mass = 8.68×10^{25} kg
- Bulk density = 1.29 g/cm^3
- Mean orbital radius = 2.87×10^9 km (19.2 AU)
- Orbital period = 84.01 years
- Rotational period = 17.24 hours
- Methane clouds give Uranus the bluish color.
- 27 moons
- Axial tilt $\sim 98^\circ$ from upright.
- First planet discovered with a telescope.

The closer the planets are to Earth, the more information we know about them.

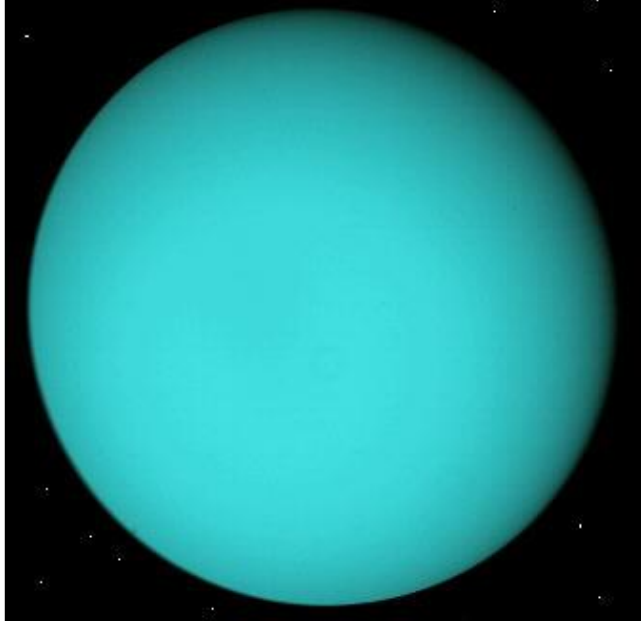
The farther away planets are from Earth, the less information we know about them.

- High resolution ground-based telescopes (like Keck)
- High resolution orbiting telescopes (like Hubble)
- Fly-by satellites (like Voyager I and Voyager II)
- Planet orbiting satellites (like Galileo)
- Landers (like Perseverance)

- We know the most about planet Mars.
- We know a lot of information about Venus, Jupiter & Saturn
- We know the least about Uranus and Neptune

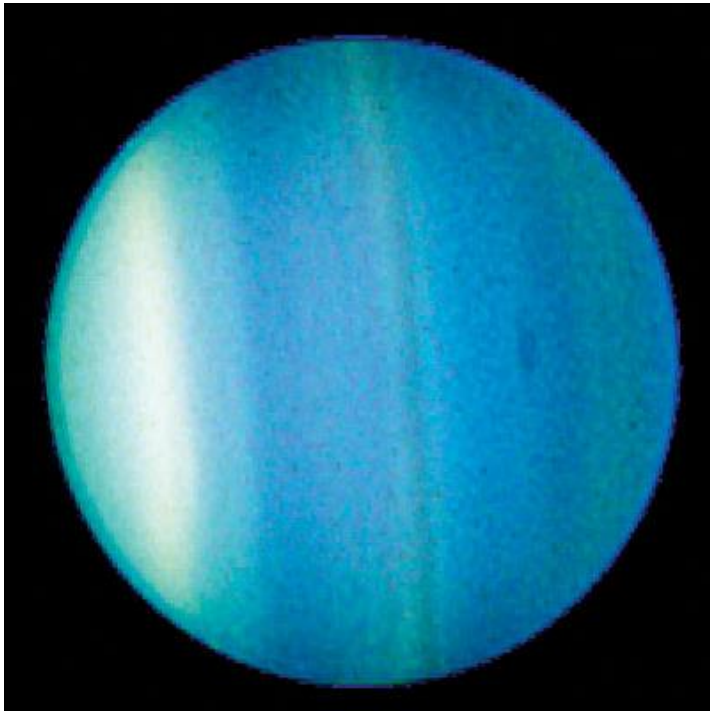


Uranus and Neptune are the ice giant planets. Ice giant planets have thinner hydrogen and helium atmospheres than the giant planets. Their large mantles are made of swirling slushy water ice, ammonia ice, and methane ice.



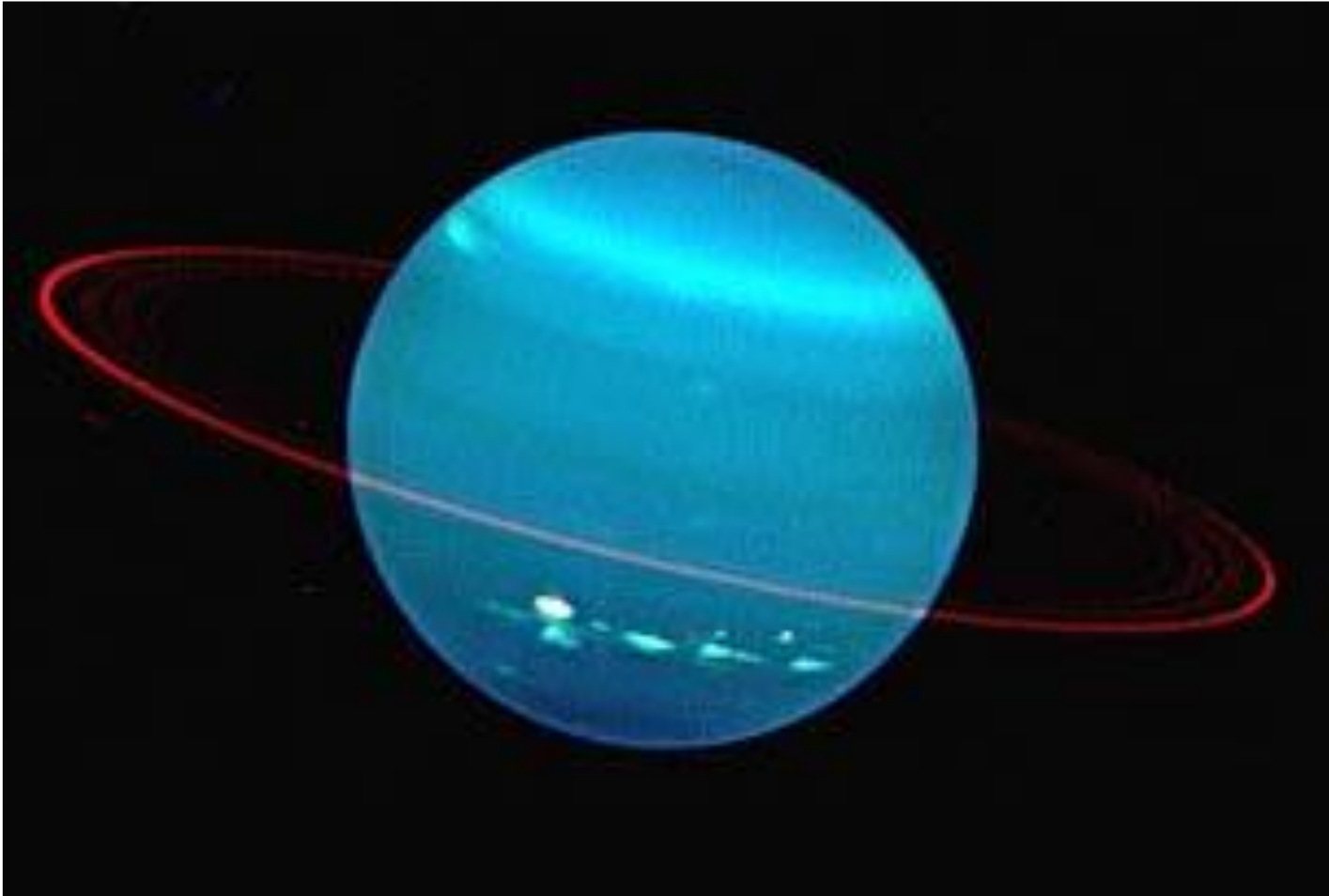
Uranus's greenish blue color is due to the methane clouds in the upper atmosphere.

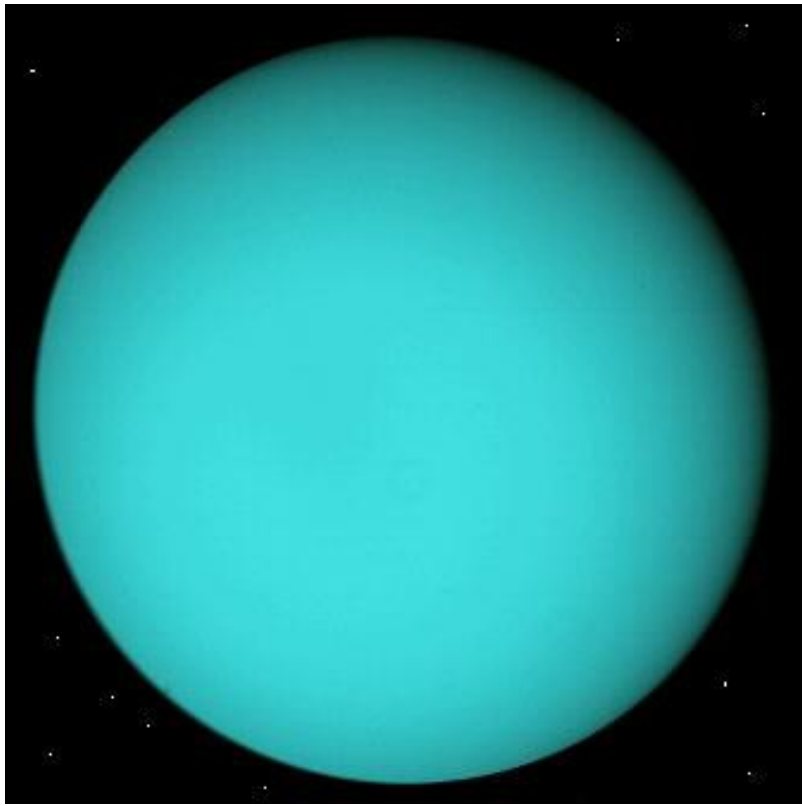
The image was taken by Voyager II in 1986.



Higher resolution images with false color enhancement from Hubble Space Telescope in 2006 reveal wind bands and storms in Uranus's upper atmosphere. There were larger darker storms in the clouds.

Uranus has a thin ring system. The rings are visible only when backlit by the Sun. They were discovered by Voyager II in 1986 during its flyby as it looked back on Uranus.





Uranus was the first planet discovered by telescope. William Herschel and his sister discovered Uranus in 1781. Something in space near Saturn was disturbing Saturn's movement. They focused their telescopes in that region of space and found a new planet.

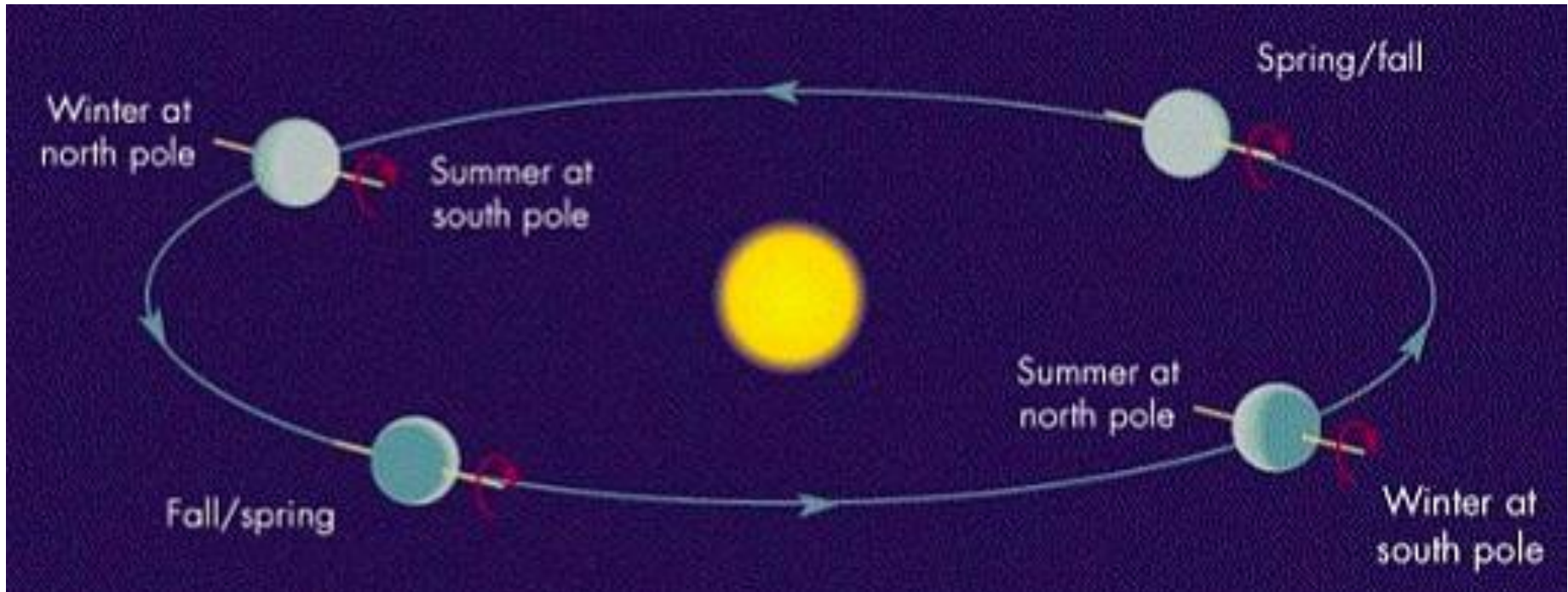
Mercury, Venus, Mars, Jupiter, and Saturn are visible from Earth without a telescope.



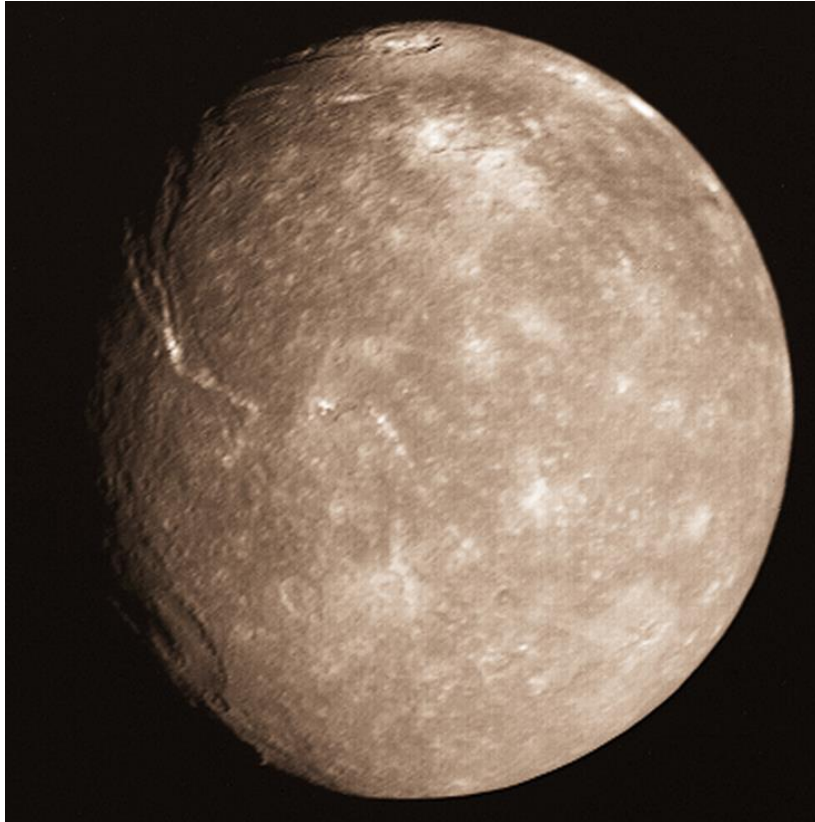
axial tilt 97.77°
Uranus

Uranus has been knocked on its side. Uranus's axis of rotation is tilted by 97.8° from upright. It also has retrograde rotation, rotating clockwise relative to the north pole.

Uranus's seasons have the north pole and south pole pointing directly at the Sun (or away from the Sun) during its summer and winter seasons.



Titania (largest moon)



Oberon



Uranus's icy moons are named after characters from Shakespeare plays or from classic English literature instead of the names of gods and demigods.

Miranda's icy and rocky surface is a patchwork of weird terrain, cratered surfaces, and faulted. The cliffs in between the ridges are deeper than the Grand Canyon.



The twisted mismatched terrain is possibly caused by a large meteor impact that crushed and melted the icy crust that then cracked and faulted as it refroze.

Neptune

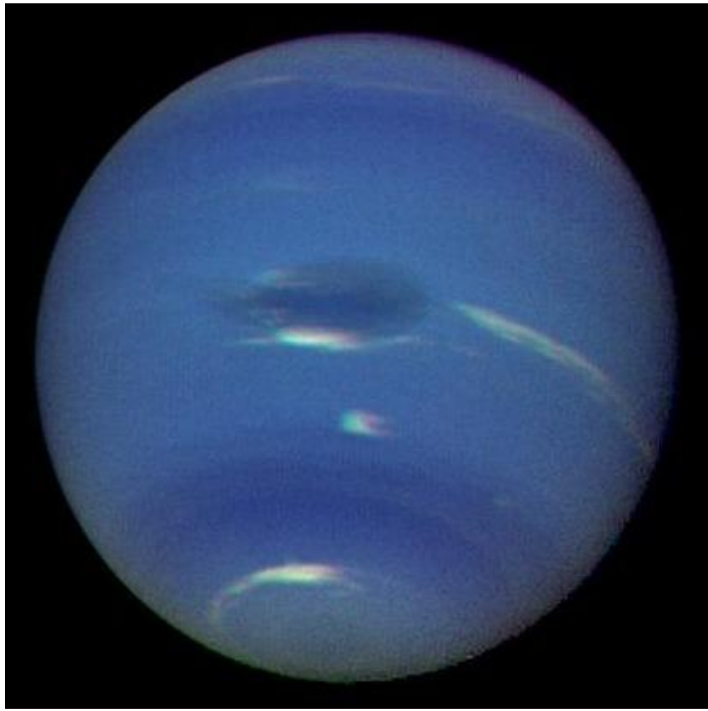
- Eighth planet from the sun.
- Equatorial diameter = 4.95×10^4 km
- Planetary mass = 1.02×10^{26} kg
- Bulk density = 1.64 g/cm³
- Mean orbital radius = 4.50×10^9 km (30 AU)
- Orbital period = 164.8 years
- Rotational period = 16.11 hours
- 14 moons (Triton is the largest)
- Blue color due to methane and ammonia clouds in the upper atmosphere.
- *Great Dark Spot*



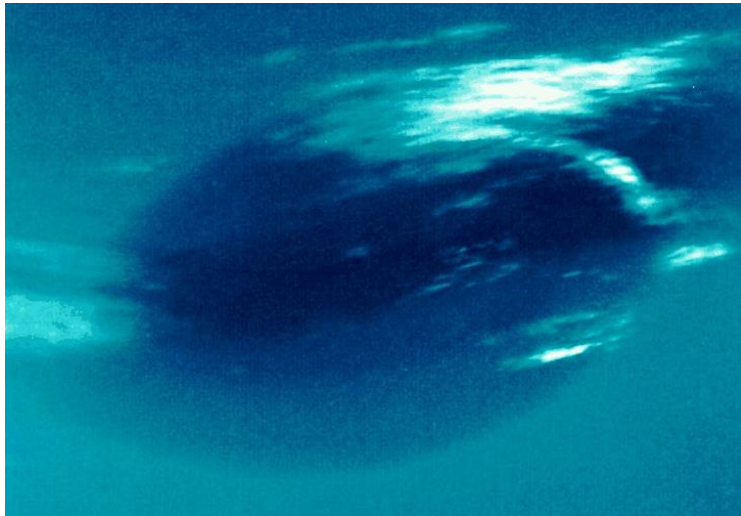
Neptune's bluish color is due to the methane and ammonia clouds in the upper atmosphere.

The image was taken by Voyager II in 1989.

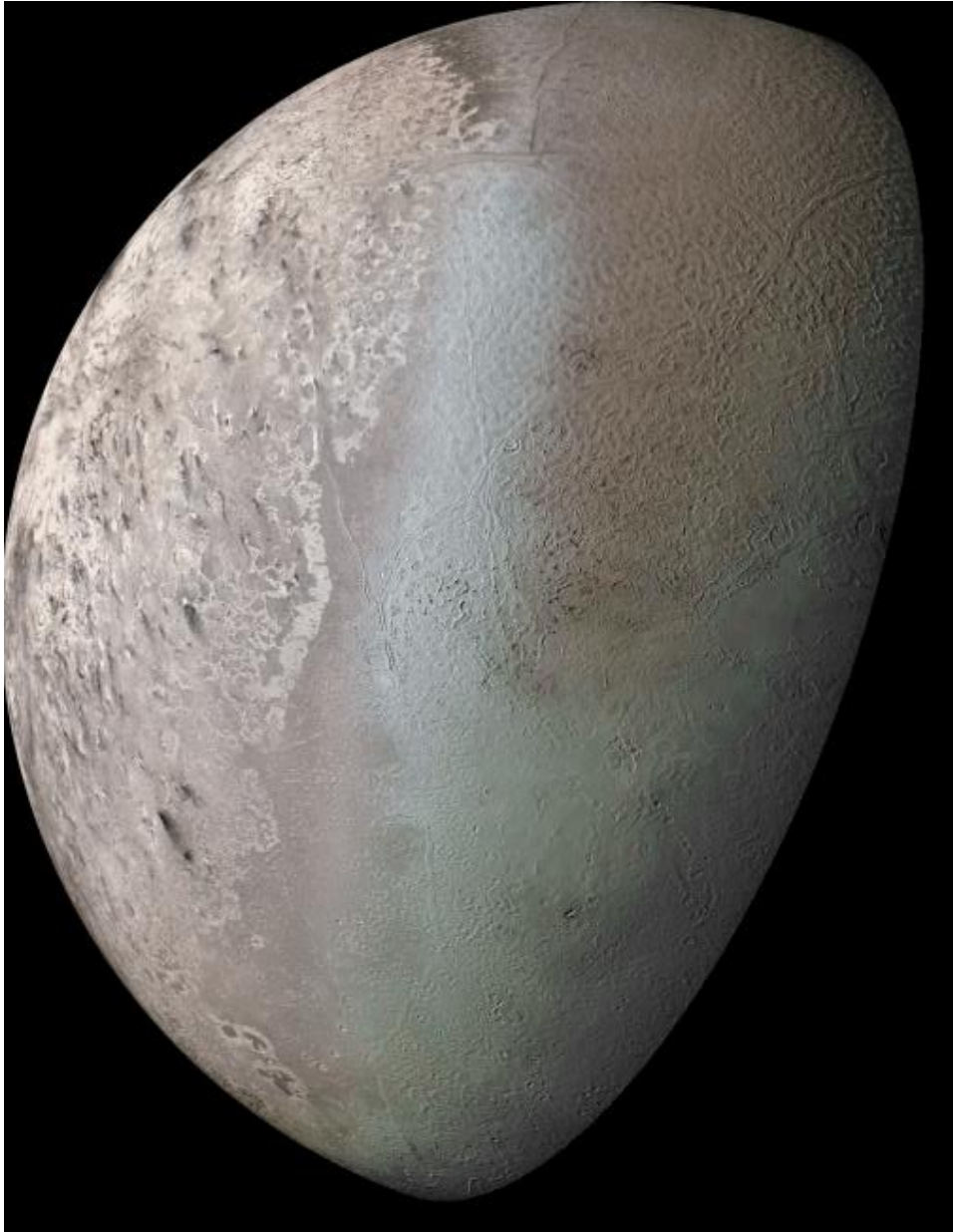
Neptune has the fastest wind speeds of all of the planets. The wind bands move 300-400 km/hr.



Voyager II took photographs of the **Great Dark Spot**, a large hurricane system in Neptune's southern hemisphere. (Close up in the bottom photo).



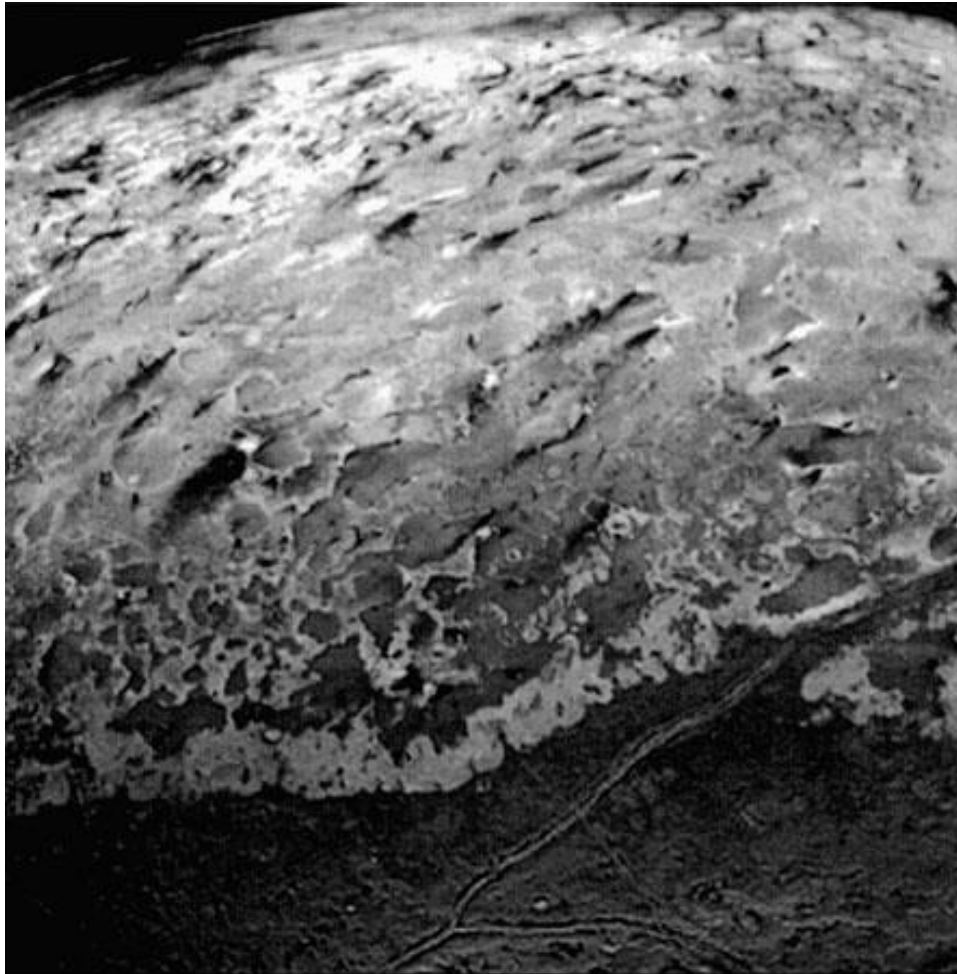
The Great Dark Spot is transient. The original had disappeared and new dark spot storms appear in different locations every 3-5 years. Scientists think the storms dissipates then a new storm of similar strength develops elsewhere.



Triton is Neptune's largest moon. Triton is the 7th largest moon in the solar system.

Triton's crust is a pinkish white icy crust made of frozen nitrogen over a water ice mantle. There are regions of the crust that are smooth, other regions are rough with craters and small icy volcanoes.

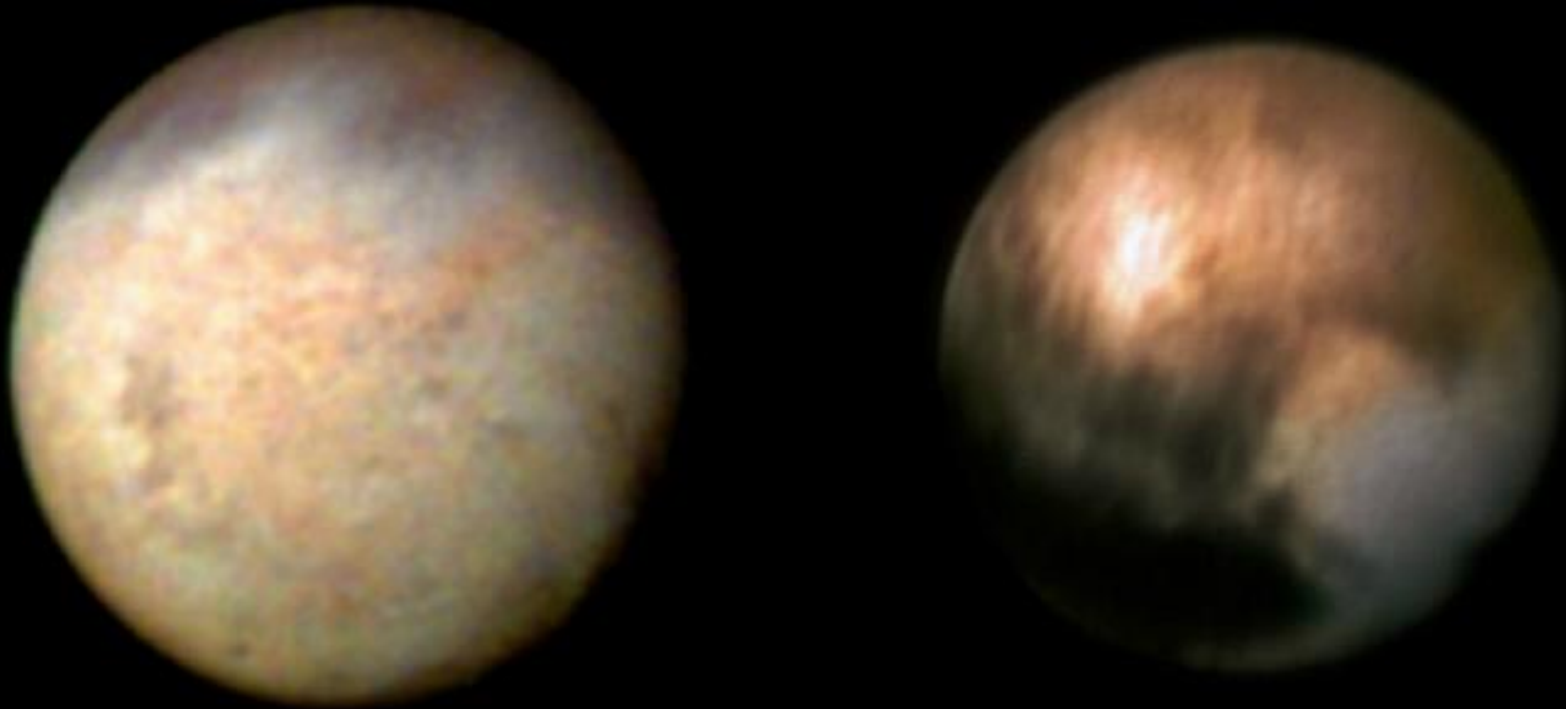
Like Enceladus, Triton has ice volcanoes that blast plumes and jets of ice, liquid water, and gases 10's to 100's of km upward above the Triton's surface.



Neptune's gravity is causing tidal deformation to Triton's interior, creating the intense heat from friction.

Triton is theorized to be a captured **ice dwarf planet** from the Kuiper Belt. Triton is similar in size, color, and in composition to Pluto. Triton formed in the Kuiper Belt, drifted too close to Neptune. Neptune's gravity pulled it into a close orbit.

Triton vs Pluto



Triton is the only large moon in the solar system with retrograde rotation. It orbits Neptune in the direction opposite that Neptune rotates. Triton's orbital distance is decreasing, it is spiraling inward towards Neptune.

