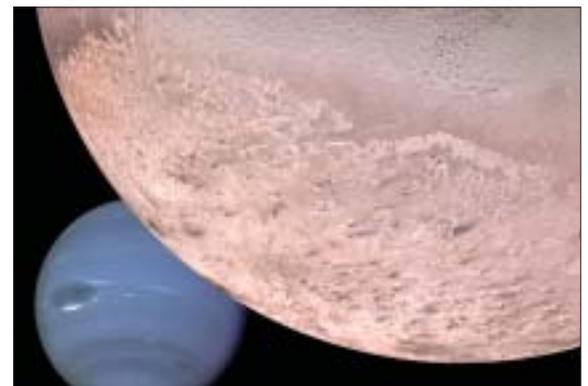
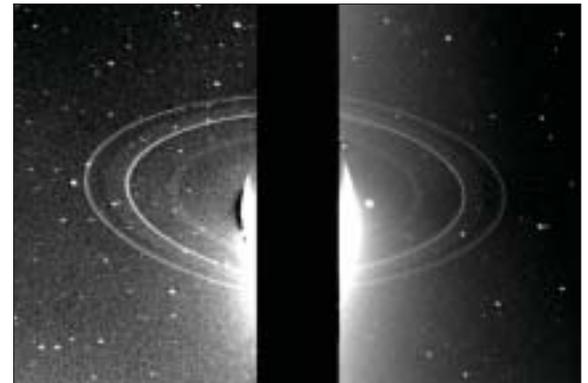




National Aeronautics and  
Space Administration

Neptune  $\Psi$





The eighth planet from the Sun, **NEPTUNE** was the first planet located through mathematical predictions rather than through regular observations of the sky. When Uranus didn't travel exactly as astronomers expected it to, two mathematicians, working independently of each other, proposed the position and mass of another, as yet unknown planet that could account for Uranus' orbit. Although "the establishment" ignored the predictions, a young astronomer decided to look for the predicted planet. Thus, Neptune was discovered in 1846. Seventeen days later, its largest moon, Triton, was also discovered.

Nearly 4.5 billion kilometers from the Sun, Neptune orbits the Sun once every 165 years, and therefore it has not quite made a full circle around the Sun since it was discovered. It is invisible to the naked eye because of its extreme distance from Earth. Interestingly, due to Pluto's unusual elliptical orbit, Neptune is actually the farthest planet from the Sun for a 20-year period out of every 248 Earth years.

Neptune has the smallest diameter of our solar system's giant gas planets (including Jupiter, Saturn, and Uranus), so called because they have no solid surfaces. Even so, its volume could hold nearly 60 Earths. Neptune's atmosphere extends to great depths, gradually merging into water and other "melted ices" over a heavier, approximately Earth-sized liquid core.

Neptune's rotational axis is tilted 30 degrees to the plane of its orbit around the Sun. Its seasons last an incredible 41 years. During the southern summer, the south pole is in constant sunlight for about 41 years, and in northern summer, the north pole is in constant sunlight for about 41 years.

Neptune's atmosphere is made up of hydrogen, helium, and methane, the last of these giving the planet its blue color (because methane absorbs red light). Despite its great distance from the Sun and lower energy input, Neptune's winds are three times stronger than Jupiter's and nine times stronger than Earth's.

In 1989, *Voyager 2* tracked a large oval dark storm in Neptune's southern hemisphere. This hurricane-like "Great Dark Spot" was large enough to contain the entire Earth; spun counterclockwise; and moved westward at almost 1,200 km per hour. Recent images from the *Hubble Space*

*Telescope* show no sign of the "Great Dark Spot," although a comparable spot appeared in 1997 in Neptune's northern hemisphere.

The planet has several rings of varying widths, confirmed by *Voyager 2*'s observations in 1989. The outermost ring, Adams, contains five distinct arcs (incomplete rings) named Libert , Egalit  1, Egalit  2, Fraternit , and Courage. Next is an unnamed ring co-orbital with the moon Galatea, then Le Verrier, Lassell, Arago, and Galle. Neptune's rings are believed to be relatively young and relatively short-lived.

Neptune has eight known moons, six of which were discovered by *Voyager 2*. The largest, Triton, orbits Neptune in a direction opposite to the planet's rotation direction, and is gradually getting closer until it will collide with the planet in about 10 to 100 million years, forming vast rings around Neptune that will rival or exceed Saturn's extensive ring system. Triton is the coldest body yet visited in our solar system; temperatures on its surface are about -235  C. Despite the deep freeze, *Voyager 2* discovered great geysers of gaseous nitrogen on Triton.

## Fast Facts

<b>Namesake</b>	Roman God of the Sea
<b>Mean Distance from Sun</b>	4.498 billion km
<b>Orbital Period</b>	164.79 years
<b>Orbital Eccentricity</b>	0.0086
<b>Orbital Inclination to Ecliptic</b>	1.7697�
<b>Inclination of Equator to Orbit</b>	29.58�
<b>Rotational Period</b>	16 h 7 m
<b>Diameter</b>	49,528 km
<b>Mass</b>	17.141 times Earth's mass
<b>Density</b>	1.76 g/cm <sup>3</sup>
<b>Gravity</b>	1.12 of Earth's
<b>Atmosphere</b>	79% hydrogen, 18% helium, 3% methane
<b>Atmospheric Temperature at 1-bar Pressure Level</b>	73 K
<b>Moons (8) in Increasing Distance from Neptune</b>	
	Naiad, Thalassa, Despina, Galatea, Larissa, Proteus, Triton, Nereid
<b>Number of Rings</b>	4

## Significant Dates

- 1845** Mathematicians John Adams (Britain) and Jean Le Verrier (France) predict Neptune based on orbital motion of Uranus.
- 1846** German astronomer Johann Galle discovers Neptune using location predicted by Le Verrier.
- 1846** British astronomer William Lassell discovers Triton.
- 1949** American astronomer Gerald Kuiper discovers Nereid.
- 1985** Astronomers discover Neptune's rings based on star occultations.
- 1989** *Voyager 2* visits Neptune system.
- 1994** *Hubble Space Telescope* observes changes in Neptune's atmosphere.

## About the Images

**(Left)** Neptune's blue color is due to methane, which absorbs red light and reflects blue light. In 1989, *Voyager 2* tracked these three giant storms—the Great Dark Spot, Scooter, and Dark Spot 2.

**(Right, top)** *Voyager 2* photographed Neptunian clouds that are 50 kilometers above the underlying cloud decks.

**(Right, middle)** *Voyager 2* needed ten-minute exposures to capture images of Neptune's main rings.

**(Right, bottom)** Nitrogen frost coats Neptune's largest moon Triton. Bright and dark streaks are materials deposited by winds (NASA/*Voyager 2*).

### References

- 1) NASA Solar System Exploration: <http://solarsystem.nasa.gov>
- 2) *The New Solar System*, 4th ed., Beatty, Petersen, Chaikin, eds, 1999.
- 3) NASA Planetary Photojournal: <http://photojournal.jpl.nasa.gov>