Uranus

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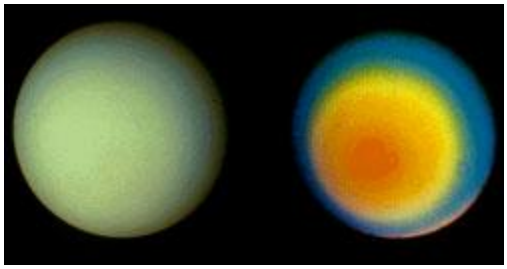
Uranus, (YUR uh nuhs or yu RAY nuhs), is the seventh planet from the sun. Only Neptune and Pluto are farther away. Uranus is the farthest planet that can be seen without a telescope. Its average distance from the sun is about 1,784,860,000 miles (2,872,460,000 kilometers), a distance that takes light about 2 hours 40 minutes to travel.



Uranus appears in true colors, left, and false colors, right in images produced by combining numerous pictures taken by the Voyager 2 spacecraft. The false colors emphasize bands of smog around the planet's south pole. The small spots are shadows of dust specks in the camera. Image credit: JPL

Uranus is a giant ball of gas and liquid. Its diameter at the equator is 31,763 miles (51,118 kilometers), over four times that of Earth. The surface of Uranus consists of blue-green clouds made up of tiny crystals of methane. The crystals have frozen out of the planet's atmosphere. Far below the visible clouds are probably thicker cloud layers made up of liquid water and crystals of ammonia ice. Deeper still -- about 4,700 miles (7,500 kilometers) below the visible cloud tops -- may be an ocean of liquid water containing dissolved ammonia. At the very center of the planet may be a rocky core about the size of Earth. Scientists doubt Uranus has any form of life.

Uranus was the first planet discovered since ancient times. British astronomer William Herschel discovered it in 1781. Johann E. Bode, a German astronomer, named it Uranus after a sky god in Greek mythology. Most of our information about Uranus comes from the flight of the United States spacecraft Voyager 2. In 1986, that craft flew within about 50,000 miles (80,000 kilometers) of the planet's cloud tops.

Orbit and rotation

Uranus travels around the sun in an elliptical (oval-shaped) orbit, which it completes in 30,685 Earth days, or just over 84 Earth years. As it orbits the sun, Uranus also rotates on its axis, an imaginary line through its center. The planet's interior (ocean and core) takes 17 hours 14 minutes to spin around once on its axis. However, much of the atmosphere rotates faster than that. The fastest winds on Uranus, measured about two-thirds of the way from the equator to the south pole, blow at about 450 miles per hour (720 kilometers per hour). Thus, this area toward the south pole makes one complete rotation every 14 hours.

Uranus is tilted so far on its side that its axis lies nearly level with its path around the sun. Scientists measure the tilt of a planet relative to a line at a right angle to the orbital plane, an imaginary surface touching all points of the orbit. Most planets' axes tilt less than 30¡. For example, the tilt of Earth's axis is about 23 1/2. But Uranus's axis tilts 98 degrees, so that the axis lies almost in the orbital plane. Many astronomers think that a collision with an Earth-sized planet may have knocked Uranus on its side soon after it was formed.

Uranus has a mass (quantity of matter) 14 1/2 times larger than that of Earth. However, the mass of Uranus is only about 1/20 as large as that of the largest planet, Jupiter.

Uranus has an average density of 1.27 grams per cubic centimeter, or about 1 1/4 times the density of water. Density is the amount of mass in a substance divided by the volume of the substance. The density of Uranus is 1/4 that of Earth, and is similar to that of Jupiter.

The force of gravity at the surface of Uranus is about 90 percent of that at the surface of Earth. Thus, an object that weighs 100 pounds on Earth would weigh about 90 pounds on Uranus.

The atmosphere of Uranus is composed of about 83 percent hydrogen, 15 percent helium, 2 percent methane, and tiny amounts of ethane and other gases. The atmospheric pressure beneath the methane cloud layer is about 19 pounds per square inch (130 kilopascals), or about 1.3 times the atmospheric pressure at the surface of Earth. Atmospheric pressure is the pressure exerted by the gases of a planet's atmosphere due to their weight.

The visible clouds of Uranus are the same pale blue-green all over the surface of the planet. Images of Uranus taken by Voyager 2 and processed for high contrast by computers show very faint bands within the clouds parallel to the equator. These bands are made up of different concentrations of smog produced as sunlight breaks down methane gas. In addition, there are a few small spots on the planet's surface. These spots probably are violently swirling masses of gas resembling a hurricane.

Miranda, a satellite of Uranus, has three regions called ovoids whose outer ridges resemble race tracks. Internal geological activity created the ovoids, probably in the past 2 billion years. Image credit:

The temperature of the atmosphere is about -355 degrees F (-215 degrees C). In the interior, the temperature rises rapidly, reaching perhaps 4200 degrees F (2300 degrees C) in the ocean and 12,600 degrees F (7000 degrees C) in the rocky core. Uranus seems to radiate as much heat into space as it gets from the sun. Because Uranus is tilted 98¡ on its axis, its poles

receive more sunlight during a Uranian year than does its equator. However, the weather system seems to distribute the extra heat fairly evenly over the planet.

Satellites

Uranus has 21 known satellites. Astronomers discovered the 5 largest satellites between 1787 and 1948. Photographs by Voyager 2 in 1985 and 1986 revealed 10 additional satellites. Astronomers later discovered more satellites by using Earth-based telescopes.

Miranda, the smallest of the five large satellites, has certain surface features that are unlike any other formation in the solar system. These are three oddly shaped regions called ovoids. Each ovoid is 120 to 190 miles (200 to 300 kilometers) across. The outer areas of each ovoid resemble a race track, with parallel ridges and canyons wrapped about the center. But in the center, ridges and canyons crisscross one another randomly.

Magnetic field

Uranus has a strong magnetic field. The axis of the field (an imaginary line connecting its north and south poles) is tilted 59 degrees from the planet's axis of rotation.

The magnetic field has trapped high-energy, electrically charged particles -- mostly electrons and protons -- in radiation belts around the planet. As these particles travel back and forth between the magnetic poles, they send out radio waves. Voyager 2 detected the waves, but they are so weak that they cannot be detected on Earth.

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Voyager 2 shows crescent of Uranus
(Click on the image for a larger view)

NASA's Voyager 2 spacecraft flew closely past distant Uranus, the seventh planet from the Sun, in January 1986.

At its closest, the spacecraft came within 81,500 kilometers (50,600 miles) of Uranus's cloudtops on Jan. 24, 1986.

Voyager 2 radioed thousands of images and voluminous amounts of other scientific data on the planet, its moons, rings, atmosphere, interior and the magnetic environment surrounding Uranus.

Since launch on Aug. 20, 1977, Voyager 2's itinerary has taken the spacecraft to Jupiter in July 1979, Saturn in August 1981, and then Uranus. Voyager 2's next encounter was with Neptune in August 1989. Both Voyager 2 and its twin, Voyager 1, will eventually leave our solar system and enter interstellar space.

Voyager 2's images of the five largest moons around Uranus revealed complex surfaces indicative of varying geologic pasts. The cameras also detected 10 previously unseen moons. Several instruments studied the ring system, uncovering the fine detail of the previously known rings and two newly detected rings. Voyager data showed that the planet's rate of rotation is 17 hours, 14 minutes. The spacecraft also found a Uranian magnetic field that is both large and unusual. In addition, the temperature of the equatorial region, which receives less sunlight over a Uranian year, is nevertheless about the same as that at the poles.