

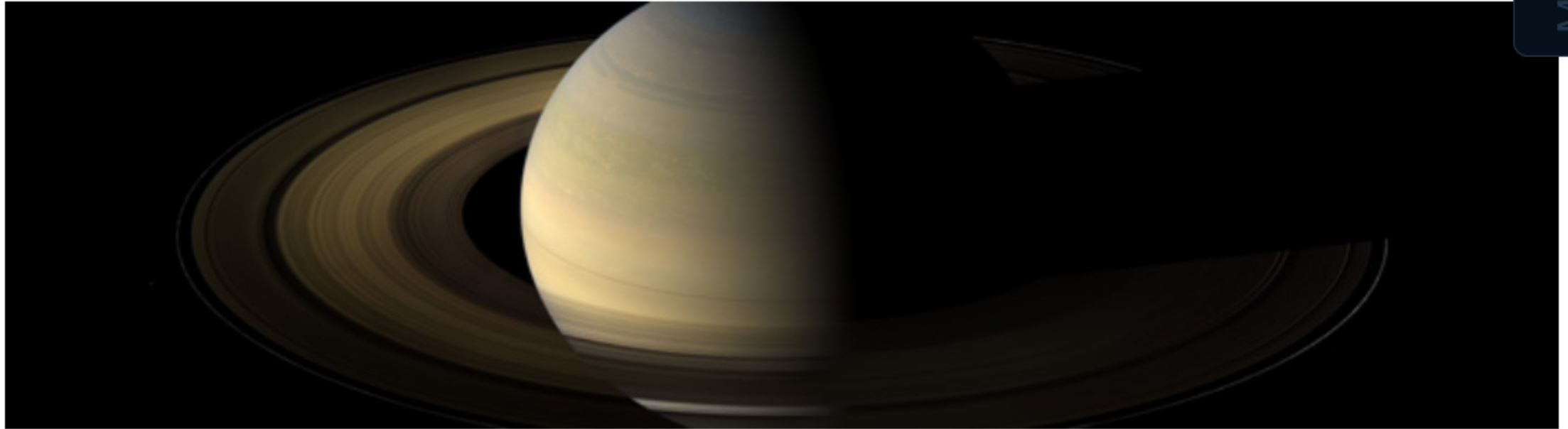


Planets



Saturn: In Depth

MENU



Cassini spacecraft's view of Saturn in 2009.

Overview

The second largest planet in our solar system, adorned with thousands of beautiful ringlets, Saturn is unique among the planets. It is not the only planet to have rings -- made of chunks of ice and rock -- but none are as spectacular or as complicated as Saturn's. Like fellow gas giant Jupiter, Saturn is a massive ball of mostly hydrogen and helium.

Surrounding by 53 confirmed and nine provisional moons, Saturn is home to some of the most fascinating landscapes in our solar system. From the jets of Enceladus to the methane lakes on smoggy Titan, the Saturn system is a rich source of scientific discovery and still holds many mysteries.

The farthest planet from Earth observable by the unaided human eye, Saturn has been known since ancient times and is named for the Roman god of agriculture and wealth. The Greek equivalent was Cronos, the father of Zeus/Jupiter.

Formation:

When the solar system settled into its current layout about 4.5 billion years ago, Saturn formed when gravity pulled swirling gas and dust in to become a planet 886 million miles (1.4 billion km) from the sun. Like Jupiter, Saturn is mostly made of hydrogen and helium, the same two main components that make up the sun.

Saturn rotates in the same direction as the Earth, which is west to east, but it does this far faster than Earth, spinning around once in just 10.7 hours. This fast spin causes Saturn to bulge out in the middle, making its equatorial radius nearly 10 percent wider than its polar radius.

Its axis is tilted by 26.73 degrees with respect to its orbit around the sun, which is similar to Earth's 23.5-degree tilt. This means that, like Earth, Saturn experiences seasons.

While the days on Saturn are short, the years are long. The sixth planet from the sun takes 29 Earth years, or 10,756 Earth days, to complete one revolution around the sun.

Structure:

Like Jupiter, Saturn is made mostly of hydrogen and helium. At Saturn's center is a dense core of rock, ice, water,

and other compounds made solid by the intense pressure and heat. It is enveloped by liquid metallic hydrogen, inside a layer of liquid hydrogen -- similar to Jupiter's core but considerably smaller.

It's hard to imagine, but Saturn is the only planet in our solar system that is less dense than water. The giant gas planet could float in a bathtub -- if such a colossal thing existed.

Surface

As a gas giant, Saturn doesn't have a true surface. The planet is mostly swirling gases and liquids. While a spacecraft would have nowhere to land on Saturn, it wouldn't be able to fly through unscathed either. The extreme pressures and temperatures deep inside the planet would crush, melt and vaporize a metal spacecraft trying to fly through the planet.

Atmosphere:

Saturn is blanketed with clouds, stripes and storms. Overall the planet is tan and light brown in color, due to a mixture of yellow ammonia crystals in the upper atmosphere.

Winds in the upper atmosphere reach 1,600 feet (500 meters) per second in the equatorial region. In contrast, the strongest hurricane-force winds on Earth top out at about 360 feet (110 meters) per second. And the pressure -- the same kind you feel when you dive deep underwater -- is so powerful it squeezes gas into liquid. Even a metal spacecraft would be smashed in Saturn's intense atmosphere.

Saturn's north pole has an interesting atmospheric feature -- a six-sided jet stream. This hexagon-shaped pattern was first noticed in images from the Voyager I spacecraft and has been more closely observed by the Cassini spacecraft since. Spanning about 20,000 miles (30,000 km) across, the hexagon is a wavy jet stream of 200-mile-per-hour winds (about 322 kilometers per hour) with a massive, rotating storm at the center. There is no weather feature like it anywhere else in the solar system.

Potential for Life:

Saturn's environment is not conducive to life as we know it. The temperatures, pressures, radiation levels and materials that characterize this planet are most likely too extreme and volatile for organisms to adapt to.

While planet Saturn is an unlikely place for living things to take hold, the same is not true of some of its many moons. Satellites like Enceladus and Titan, home to internal oceans, could possibly support life.

Moons:

Saturn is home to a vast array of intriguing and unique worlds. From the cloud-shrouded surface of Titan to crater-riddled Phoebe, each of Saturn's moons tells another piece of the story surrounding the Saturn system. Currently Saturn has 53 confirmed moons with nine additional provisional moons awaiting confirmation.

Saturn's largest satellite, Titan, is a bit bigger than the planet Mercury. Titan is the second-largest moon in the solar system; only Jupiter's moon Ganymede is bigger.

Rings:

Saturn's rings are believed to be pieces of comets, asteroids or shattered moons that broke up before they reached the planet, torn apart by Saturn's powerful gravity. They are made of billions of small chunks of ice and rock. The ring particles mostly range from tiny, dust-sized icy grains to chunks as big as a house, though a few particles are as large as mountains. The rings would look mostly white if you looked at them from the cloud tops of Saturn.

Saturn's ring system extends up to 175,000 miles (282,000 km) from the planet, yet the vertical height is typically about 30 feet (10 meters) in the main rings. Among the ring system are "braided" rings, ringlets and "spokes" -- dark features in the rings that form and initially circle the planet at different rates from that of the surrounding ring material. Two tiny moons, Pan and Daphnis, orbit in gaps (Encke and Keeler gaps, respectively) in the rings and keep the gaps open. Other particles are too tiny to see, but create propeller-shaped objects in the rings that let us know they are there.

Named alphabetically in the order they were discovered, the rings are relatively close to each other, with the exception of the Cassini Division, a gap measuring 2,020 miles (4,700 km). The main rings are working outward

exception of the Cassini Division, a gap measuring 2,920 miles (4,700 km). The main rings are, working outward from the planet, known as C, B and A. The Cassini Division is the largest gap in the rings and separates Rings B and A. In addition, a number of fainter rings have been discovered more recently. The D Ring is exceedingly faint and closest to the planet. The F Ring is a narrow feature just outside the A Ring. Beyond that are two far fainter rings named G and E. Interestingly, each ring orbits at a different speed around the planet.

Magnetosphere:

Saturn's magnetic field is smaller than Jupiter's but still 578 times as powerful as Earth's. Saturn, the rings, and many of the satellites lie totally within Saturn's enormous magnetosphere, the region of space in which the behavior of electrically charged particles is influenced more by Saturn's magnetic field than by the solar wind.

Aurorae occur when charged particles spiral into a planet's atmosphere along magnetic field lines. On Earth, these charged particles come from the solar wind. Cassini showed that at least some of Saturn's aurorae are like Jupiter's and are largely unaffected by the solar wind. Instead, these aurorae are caused by a combination of particles ejected from Saturn's moons and Saturn's magnetic field's rapid rotation rate. But these "non-solar-originating" aurorae are not completely understood yet.

Exploration

Saturn was the most distant of the five planets known to the ancients. In 1610, Italian astronomer Galileo Galilei was the first to gaze at Saturn through a telescope. To his surprise, he saw a pair of objects on either side of the planet. He sketched them as separate spheres, thinking that Saturn was triple-bodied. In 1659, Dutch astronomer Christiaan Huygens, using a more powerful telescope than Galileo's, proposed that Saturn was surrounded by a thin, flat ring.

More recently, the Saturn system has been visited by passing spacecraft, the Cassini orbiter and the Huygens probe.

700 BCE: The oldest written records documenting Saturn are attributed to the Assyrians, described the ringed planet as a sparkle in the night and named it "Star of Ninib."

400 BCE: Ancient Greek astronomers named what they thought was a wandering star in honor of Kronos, the god of agriculture. The Romans later change the name to Saturn, their god of agriculture.

July 1610:: Galileo Galilei spots Saturn's rings through a telescope, but mistakes them for a "triple planet."

1655:: Christiaan Huygens discovers Saturn's rings and its largest moon, Titan.

1675:: Italian-born astronomer Jean-Dominique Cassini discovered a "division" between what are now called the A and B rings.

1 Sep 1979:: Pioneer 11 was the first spacecraft to reach Saturn. Among Pioneer 11's many discoveries are Saturn's F ring and a new moon.

1979 and 1981:: In its 1979 flyby of Saturn, Voyager 1 reveals the intricate structure of the ring system, consisting of thousands of bands. Flying even close to Saturn in 1981, Voyager 2 provided more detailed images and documents the thinness of some of the rings.

1 Jul 2004:: NASA's Cassini spacecraft becomes the first to orbit Saturn, beginning a decade-long mission that revealed many secrets and surprises about Saturn and its system of rings and moons.

14 Jan 2005:: The European Space Agency's Huygens probe is the first spacecraft to make a soft landing on the surface of another planet's moon - Saturn's giant moon Titan. The probe provided a detailed study Titan's atmosphere during a 2 hour and 27 minute descent and relayed data and images from Titan's muddy surface for another hour and 10 minutes.

17 Sep 2006 Scientists discover a new ring. The new ring coincides with the orbits of Saturn's moons Janus and Epimetheus. Images obtained during the longest solar occultation of Cassini's four-year mission revealed the ring. During a solar occultation, the sun passes directly behind Saturn, causing the rings to be brilliantly backlit. Usually,

During a solar occultation, the sun passes directly behind Saturn causing the rings to be brilliantly backlit. Usually, an occultation lasts only about an hour, but in this instance it lasted 12 hours.

Pop Culture

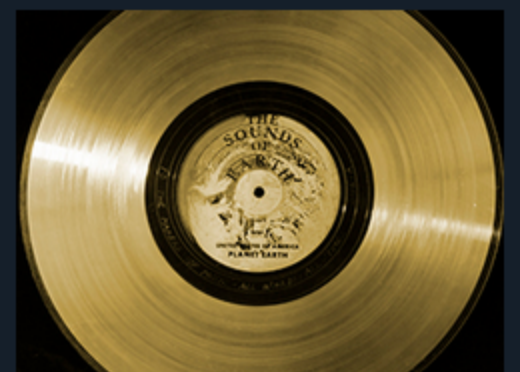
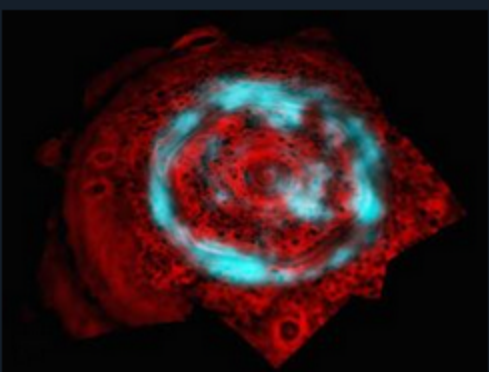
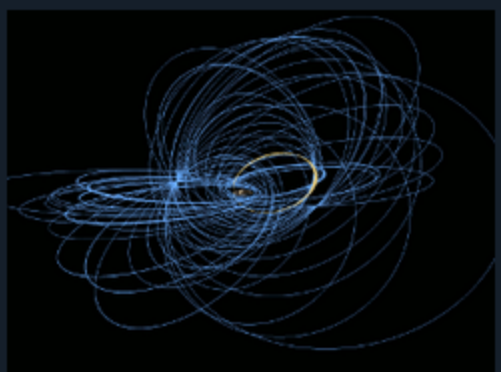
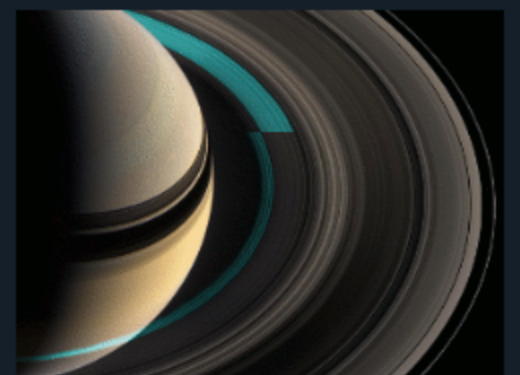
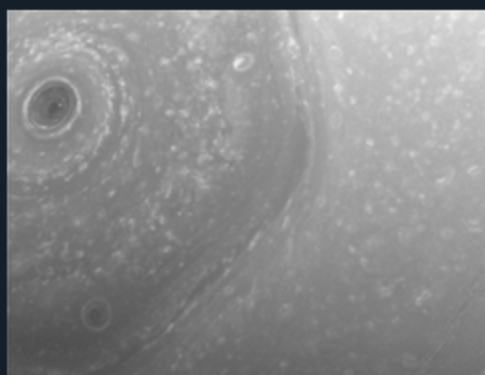
Perhaps the most iconic of all the planets in our solar system, Saturn is heavily present in pop culture. It provides a backdrop for numerous science fiction stories, movies and TV shows, comics, and video games, including the Cthulhu Mythos, WALL-E, 2001: A Space Odyssey, Star Trek, Dead Space 2 and Final Fantasy VII. In Tim Burton's film Beetlejuice, a dusty, fictional Saturn is populated by giant sandworms. Saturn is also the namesake of Saturday.

Saturn Images

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Chuck Berry and Carl Sagan



PEOPLE



Richard "Rick" Grammier
Former Director for Solar System Exploration

"His spirit will continue to inspire us as we continue our quest to understand the Universe." [more](#) ▶

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