

Jupiter



Facts and Figures

Jupiter is the 5th planet from the Sun and it is the largest planet in our Solar System. It can be seen in the night sky during Space Week 2020, appearing as a bright star low in the south after sunset and it is brighter than any of the actual stars that are visible.

Jupiter is 5.2 Astronomical Units from the Sun. An Astronomical Unit is the average distance between the Sun and the Earth. It takes 43 minutes for sunlight to reach Jupiter after leaving the Sun's surface. It takes Jupiter only 9.5 hours to spin once on its axis, which means a day on Jupiter is only 9.5 hours long. It takes Jupiter 11.86 Earth years to do one whole orbit around the Sun, which is one year in Jovian time.



Image of Jupiter, Hubble Space Telescope released in June 2019. Credits: NASA, ESA, A. Simon (Goddard Space Flight Center) and M.H. Wong (University of California, Berkeley)

A Gas Giant

Jupiter is a gas giant, which means it is very different from Earth. Here on Earth, we can stand on the planet, and walk around on its surface. However, Jupiter is just a very, very large ball of gas. That does not mean, however, that one can pass through the planet without any issues. If a space probe were sent to Jupiter it would never find solid ground. As the probe enters the atmosphere on Jupiter (there is very little to distinguish the atmosphere from the planet itself), it would move easily through gas. However, as the probe continues its journey deep into the planet, it would experience more and more pressure from the gas above it, just like a submarine deep in the Earth's ocean. Eventually, the pressure would become too much and the space probe would be crushed and destroyed so it would not be able to complete its journey through the planet.

The gases that make up Jupiter are mostly hydrogen and helium, which are the two lightest, most basic gases in the Universe. These gases are put under so much pressure

deep in the atmosphere of the planet, they turn into a liquid. Hydrogen and helium are the two main gases used as fuel in our Sun; they produce the heat we all need to survive here on Earth. The reason why Jupiter does not produce energy the same way as the Sun is because it is not big enough for nuclear fusion to occur, which is how the energy is extracted from the gases in the Sun.

The Moons

Another way Jupiter is very different from Earth is the number of moons it has. While Earth only has one moon, Jupiter has a total of 79 moons, plus many even tinier moonlets. A moon can be any size, the only requirement to be a moon is for an object to be in orbit around Jupiter. Because of this, there is a wide range of size of Jovian moons; with the smallest moons being less than a kilometer wide, to Ganymede, which is the largest moon in the Solar System, even



Jupiter and its 4 largest moons. Image credit: *Michael Stegina/Adam Block/NOAO/AURA/NSF*

larger than the planet Mercury. This number of moons is constantly changing, as every few million years moons are created or destroyed, and as we continue to discover new moons.

The four largest moons of Jupiter, Ganymede, Callisto, Europa and Io, were the first moons discovered orbiting around another planet. They are still some of the easiest to see, often being visible with just a small telescope.

The Great Red Spot and Other Storms

One of the most famous features in the atmosphere of Jupiter is the Great Red Spot. It is visible through medium to large telescopes when it is on the side of Jupiter facing the Earth. It is similar to a hurricane or cyclone here on Earth, a fast spinning circle of gas. At 16,000km across, it's wide enough to swallow our whole planet and has wind speeds of over 400km/h!

The spot has been continuously observed since 1878, making it at least 142 years old. However, there were earlier observations of a spot on Jupiter: a red spot was described in 1711; while a permanent spot was mentioned in 1665. If these descriptions were of the same storm, it will be 355 in 2020.

The Great Red Spot has been steadily shrinking since the 1890s. Originally, it was measured at 36,000km across, almost three Earths long. As well as shrinking to just about one Earth wide, it has become more circular, originally appearing to be an oval.

Missions to Jupiter

Jupiter has been visited by man-made probes nine times in the history of space exploration. Most of these visits were flybys, where a probe uses Jupiter's gravity to pull it

further out into the Solar System. These gravity assists help probes to save fuel and make Jupiter the most visited planet in the outer Solar System.

The first probe that studied Jupiter up close was NASA's Pioneer 10, which was launched in March 1972. It was followed the next year by Pioneer 11, and together they gave the first conclusive evidence that Jupiter had a magnetic field. Jupiter was next visited by the Voyager probes, in 1979. These two probes passed close to the planet's upper atmosphere and discovered its thin rings, which are far thinner and harder to see than Saturn's. They discovered volcanoes on the moon Io and even discovered some small moons including Adrastea and Metis.

Galileo was the first space probe sent to specifically study Jupiter, and the first to enter Jupiter's orbit. The probe was launched in 1989 and used flybys of Earth and Venus to reach Jupiter in 1995. On the way, it was able to photograph comet Shoemaker-Levy 9 break-up and crash into Jupiter's atmosphere in 1994. It studied the planet for 8 years, even dropping a probe into the planet's atmosphere, before it was plunged into Jupiter's atmosphere itself, to ensure that it didn't crash into the moon Europa, which has liquid water under its surface. Jupiter has had many other flybys, from probes like Ulysses, Cassini and New Horizons, but the next probe to orbit Jupiter was Juno, arriving at the planet in 2016 and still studying it today! Its mission is planned to continue into 2021, when it will dive into Jupiter's atmosphere just like the Galileo probe. It has returned some of the clearest images of the Great Red Spot and other fea-

tures of Jupiter's atmosphere. As well as measuring windspeeds and observing Jovian lightning, it is the first space probe to carry aluminum LEGO figures.

There are planned missions to get back to Jupiter in the future. One of the most noteworthy is JUICE, the JUpter ICy moons Ex-



An artist's impression of Juno in orbit around Jupiter.
Image credit: NASA

plorer. It is planned to launch in 2022 and will study the moons Ganymede, Callisto and Europa in detail. All three of these moons have some amount of liquid water under their surfaces. JUICE will study these subsurface oceans to see if they could host life.