

Jupiter



United Nations
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Ancient observations



One of the brightest objects in the night sky, Jupiter has been observed since ancient times and was connected to the religious beliefs and mythologies of many cultures.

The Romans named Jupiter after the king of their gods.



Jupiter appears like a bright star above the marbled streets of the ancient Greek city of Ephesus, located in modern day Turkey.

Credit & Copyright: Tunç Tezel (from The World at Night)

It's a planet!

Like the four other planets that can be seen with the naked eye, Jupiter appears to move against the background stars from night to night.

In fact, the word “planet” comes from the ancient Greek word for “wanderer.”



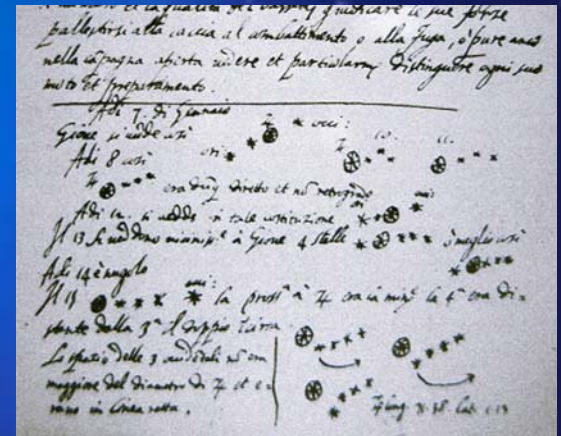
Credit: Johan Meuris/Stellarium

The planets appear to move slowly across the sky relative to the background of fixed stars.

Galileo's revolution of 1610

The Italian astronomer Galileo Galilei was the first person to point a telescope at Jupiter. Over several weeks in 1610, he was astonished to see what he called four “little stars” that appeared to orbit the planet.

The discovery that an object other than Earth had satellites, or moons, was an amazing revelation. It proved that our world was not the centre of all motion in the Universe, and provided support for the view that Earth and the other planets orbited the Sun.



Galileo's notebook, with drawings of Jupiter and its moons.



A view of Jupiter and its four largest moons, similar to what Galileo saw in 1610.

Additional links: Galileo timeline - <http://galileo.rice.edu/chron/galileo.html> or
Galileo's notes - <http://www2.jpl.nasa.gov/galileo/ganymede/discovery.html> or
Details of Galileo's discovery - http://galileo.rice.edu/sci/observations/jupiter_satellites.html#2

Other early observations

As telescopes gradually improved over the following decades, observers began to see that the planet had colorful bands and spots that changed over time and moved across the planet's face.

By observing these features, early observers realised the planet must have a substantial atmosphere. They used the motions of these features to estimate Jupiter's rotation period – the length of its day – which is about 10 hours.

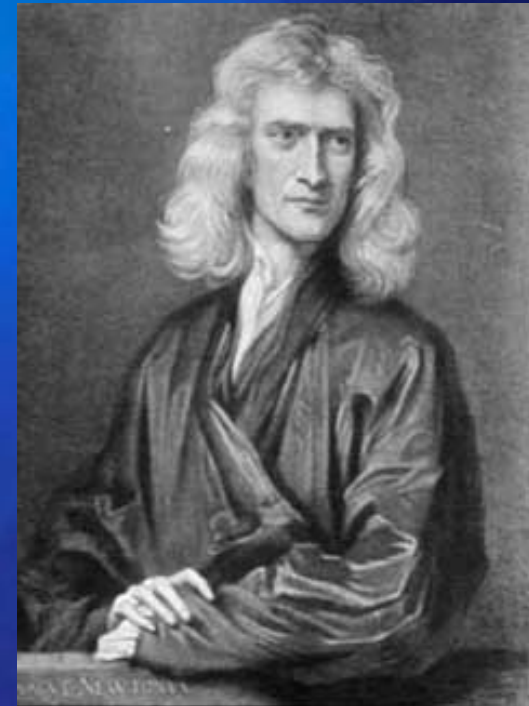


Sketch of Jupiter as observed from Glasgow, Scotland in 1897

Other observations

In 1675 Danish astronomer Ole Roemer was able to estimate the speed of light by observing eclipses of the moons Galileo discovered. He deduced that light took longer to travel the extra distance when Earth was farther from Jupiter, compared to when the planets were closer.

A few decades later, Isaac Newton used the orbits of the Galilean moons to determine that Jupiter has an enormous mass.



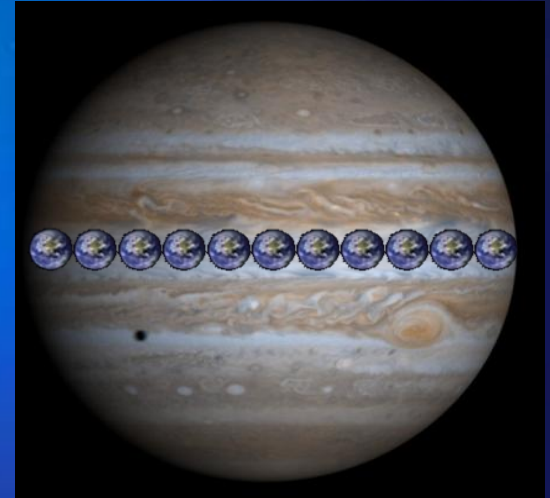
Portrait of Sir Isaac Newton

Credit: portrait by Kneller in 1689

Gas giant planet

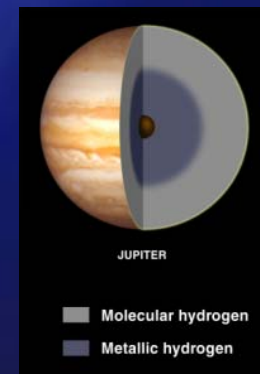
Today we know that Jupiter is an enormous swirling globe 11 times wider than Earth and 300 times more massive.

Jupiter is mostly made of hydrogen and helium gas, meaning its composition is similar to a star, like our Sun. Gas giant planets like Jupiter have no solid surface that you could stand on!



Credit: NASA

Jupiter is about 142,000 kilometres (88,000 miles) wide! This means you could fit 11 planet Earths across it.



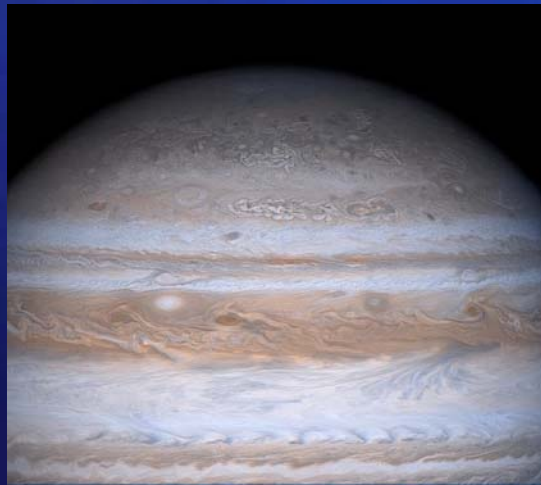
Credit: NASA

The interior of Jupiter

Bands and spots

Among its flowing bands of orange, white and brown clouds are many swirling eddies and oval-shaped storms.

The largest and best known of these vortexes is the Great Red Spot – a giant storm as wide as Earth that has been observed for more than 300 years.



Credit: NASA/JPL/University of Arizona

Swirls and eddies in the clouds of Jupiter's north.



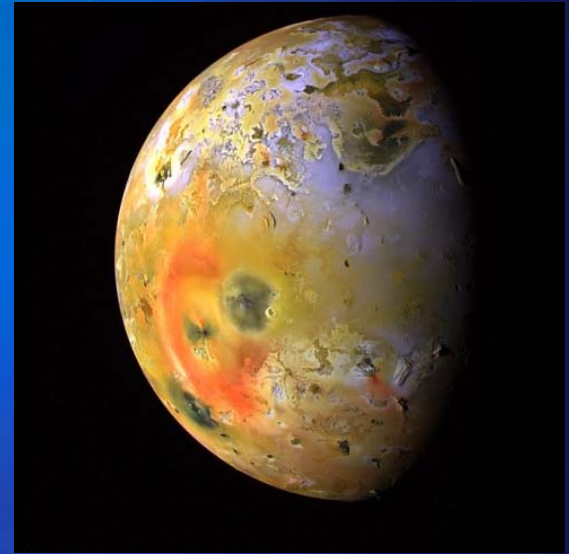
Credit: NASA/JPL

The Great Red Spot – an enormous vortex the size of Earth.

Galileo's moons: Io

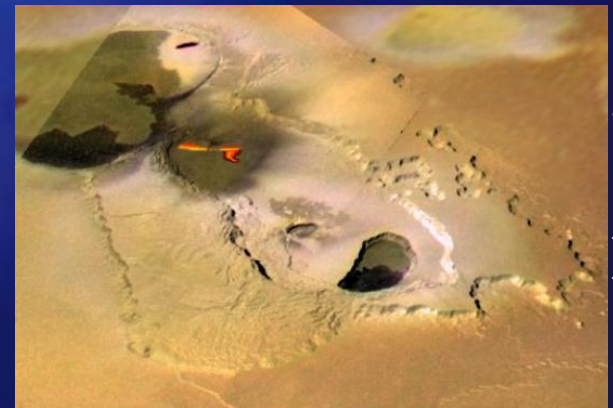
About the size of Earth's moon, Io is the closest to Jupiter of the four large moons Galileo discovered.

Io is the most volcanically active body in the Solar System, with giant volcanic plumes rising 300 kilometres (190 miles) above the surface. The surface of Io is constantly renewing itself, filling in any impact craters with molten lava lakes and spreading smooth new floodplains of liquid rock.



Credit: NASA/JPL/University of Arizona

Colourful Io: Black spots seen here are lava lakes. White is sulfur dioxide frost. Yellow is sulfur.



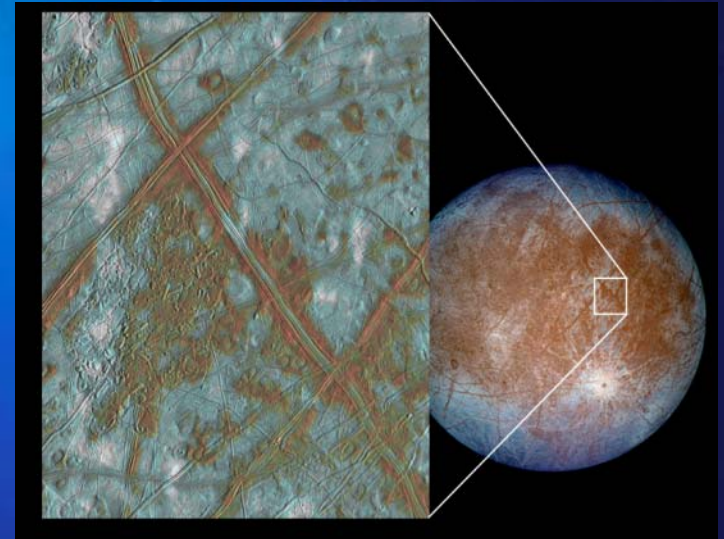
Credit: NASA/JPL/University of Arizona

Image of a volcanic eruption on Io's surface taken by the Galileo spacecraft.

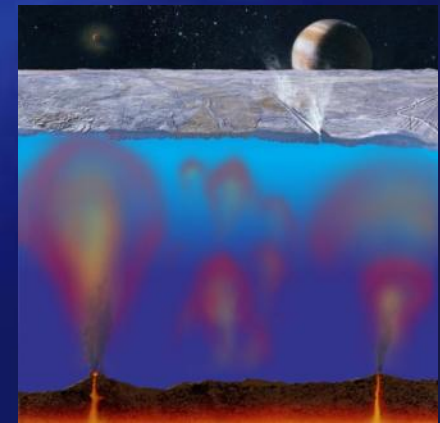
Galileo's moons: Europa

Also about the size of our Moon, **Europa** is the next large moon outward from Jupiter. It has a cracked, icy crust and very few craters, suggesting the surface is not very old.

Along with the moon's appearance, there is strong evidence that Europa contains an ocean of liquid water. This makes the moon an incredibly tempting target for exploration. If there is water, could life develop and evolve there?



Credit: NASA/JPL/University of Arizona



Credit: NASA/JPL

Scientists believe Europa contains a large ocean, but they are not sure how deep the ice covering it is.

Galileo's moons: Ganymede

Ganymede is the third large moon outward from Jupiter. Wider than the planet Mercury, it is the largest moon in the Solar System.

It is covered in fractures and streaks, similar to Europa. But unlike Europa, Ganymede has lots of craters, meaning its surface is probably much older.

Ganymede has its own magnetic field and also shows evidence that it possesses an ocean under its thick, icy crust.



Credit: NASA/JPL



Credit: NASA/JPL

The smooth, flowing lines on Ganymede show that its surface was active in the past.

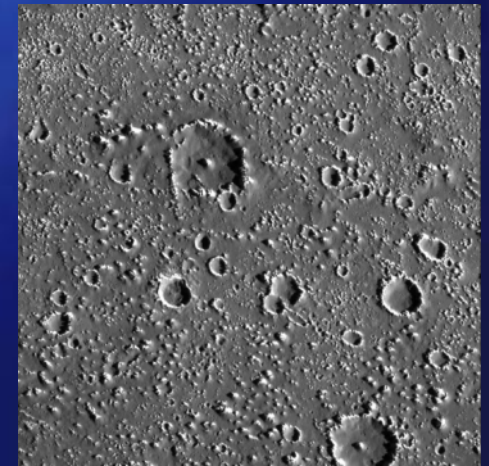
Galileo's moons: Callisto

Callisto is the outermost of the four Galilean moons and is a little smaller than Mercury. It has is the oldest, most heavily cratered surface in the Solar System.

Callisto shows few signs of ever having much activity on its surface, but interestingly it does show evidence that it possesses an internal ocean, much like Ganymede and Europa.



Credit: NASA/JPL/DLR



Credit: NASA/JPL

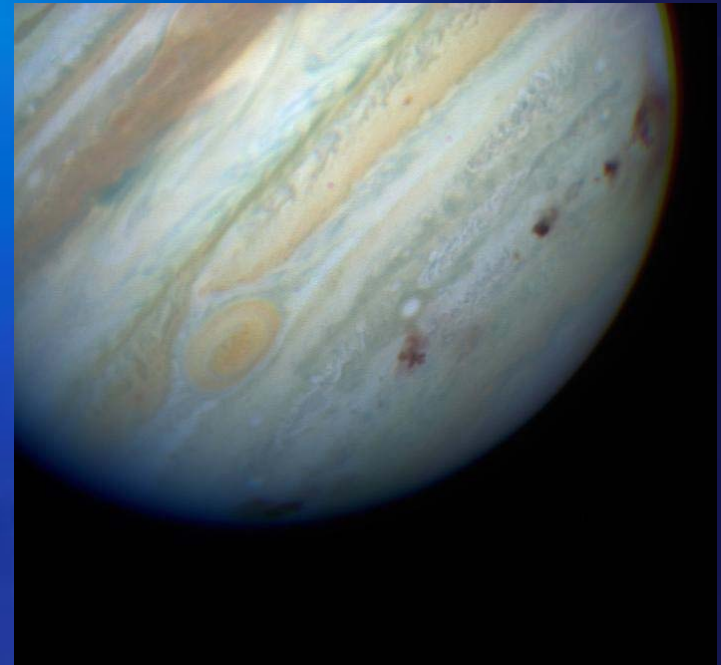
A close-up view of Callisto's heavily cratered surface, which is blanketed in a fine, dark powder.

The Solar System's vacuum cleaner

Soon after the planets formed there was a lot of leftover debris from the planet building process – things like comets and asteroids.

With its powerful gravity, Jupiter sucked up many of them and also kicked lots of them out of the Solar System that could have hit Earth. Because of this, Jupiter is sometimes called the Solar System's vacuum cleaner.

Although things have calmed down, impacts do still happen from time to time, as demonstrated again this year when an amateur astronomer discovered the aftermath of an impact which left a dark scar on the planet.



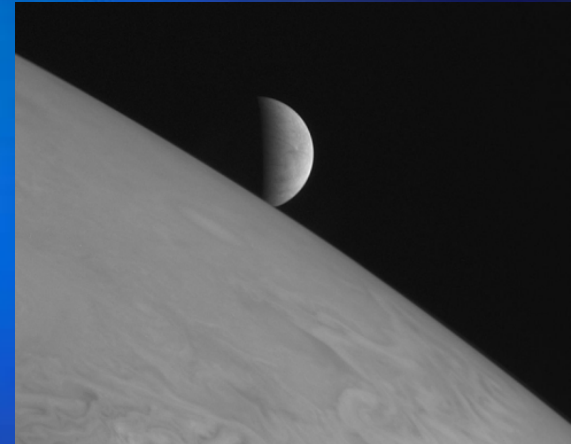
The 1994 impact of comet Shoemaker-Levy 9 into Jupiter was the first time we saw an impact on a planet as it happened. Dark scars from the comet fragments are seen on the planet in this Hubble Space Telescope image.

Missions to Jupiter

Jupiter has been visited by eight spacecraft since the 1970s. New missions are being planned to return to the giant world and resolve many unanswered questions.

In 2016, NASA's Juno spacecraft will reveal new information about how Jupiter formed and evolved into the planet we see today.

Around 2020, NASA and ESA plan to send two spacecraft to orbit Europa and Ganymede, on missions to learn whether these icy moons contain oceans where life could arise.



Europa peeks out from the limb of Jupiter in this image from the New Horizons spacecraft, which flew past Jupiter on its way to Pluto.

Credit: NASA/Johns Hopkins University
Applied Physics Laboratory/Southwest
Research Institute



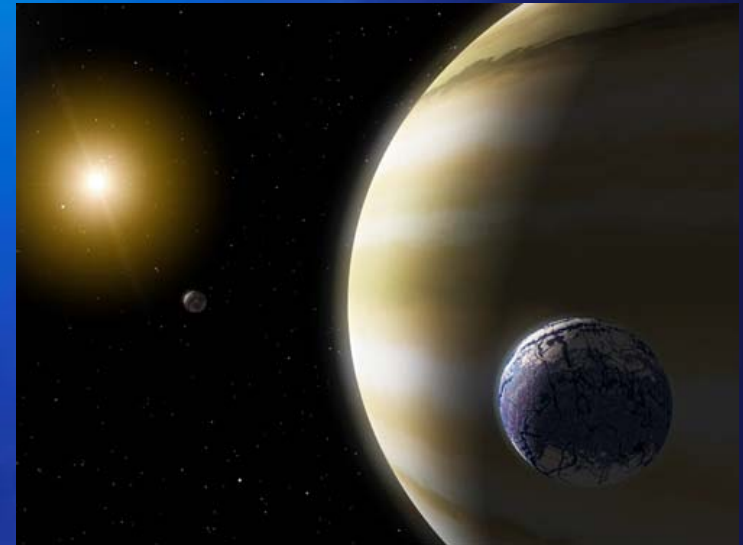
The Juno mission will unlock the story of giant planet formation.

Credit: NASA

One of many giants

Jupiter is one of four gas giant planets in our Solar System. In recent years astronomers have found many Jupiter-like planets orbiting other stars.

Lots of giant worlds throughout the cosmos probably also have icy moons like Jupiter does. If internal oceans are common in such moons, there could be many more abodes for life than just the surfaces of planets like Earth.



Artist's concept of an extrasolar, Jupiter-like planet with hypothetical water-bearing moons.

Credit: NASA/IPAC/R. Hurt

What do we learn from Jupiter?

Studying Jupiter and its moons can teach us much about the history of our Solar System and about planets orbiting other stars. Jupiter's icy moons could show us that habitable worlds might be commonplace.

By comparing Jupiter and other planets with Earth, we are able to learn a great deal about our own planet and how we came to be here.



Credit: NASA/JPL-Caltech

Giant planets like Jupiter play an important role in the planet-forming process.



Credit: NASA/JPL

Artist's concept of an Earth-like planet during its formation.



Preston Dyches (Jet Propulsion Laboratory, USA) - Galilean Nights Task Group

Galilean Nights is a Cornerstone Project of the IYA2009
<http://www.galileannights.org/>

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