

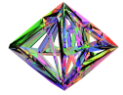
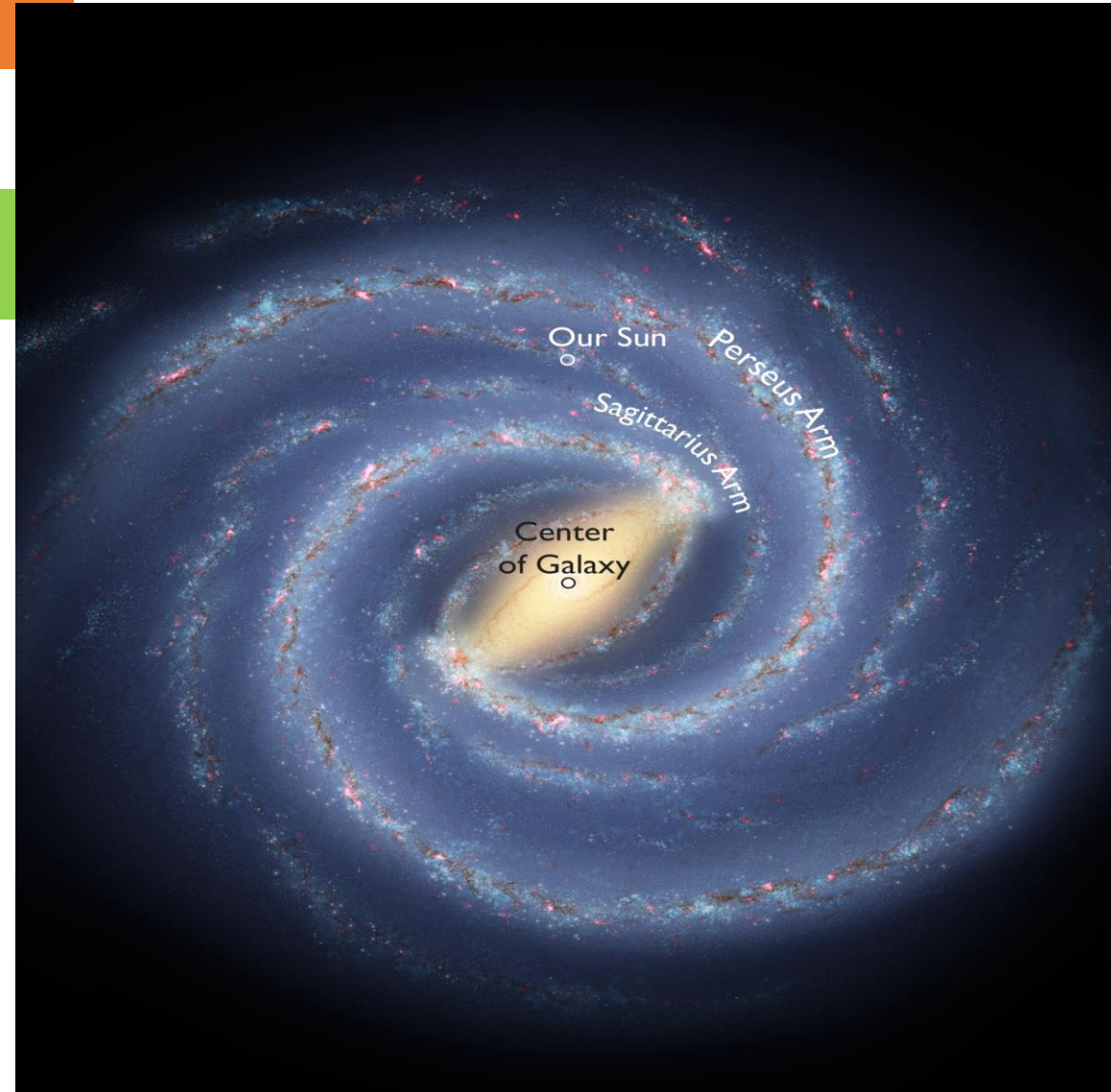
# SOLAR SYSTEM: CHARACTERISTICS

The Milky Way galaxy contains about 100 billion stars which are not uniformly distributed.

Solar System is a small part of the system of the stars known as **spiral nebula** or the **Galaxy**.

The Solar System is the gravitationally bound system of the Sun and the objects that orbit it, either directly or indirectly.

**Solar system**, assemblage consisting of the Sun—an average star in the Milky Way Galaxy—and those bodies orbiting around it: 8 (formerly 9) planets with about 210 known planetary satellites (moons); countless asteroids, some with their own satellites; comets and other icy bodies; and vast reaches of highly tenuous gas and dust.



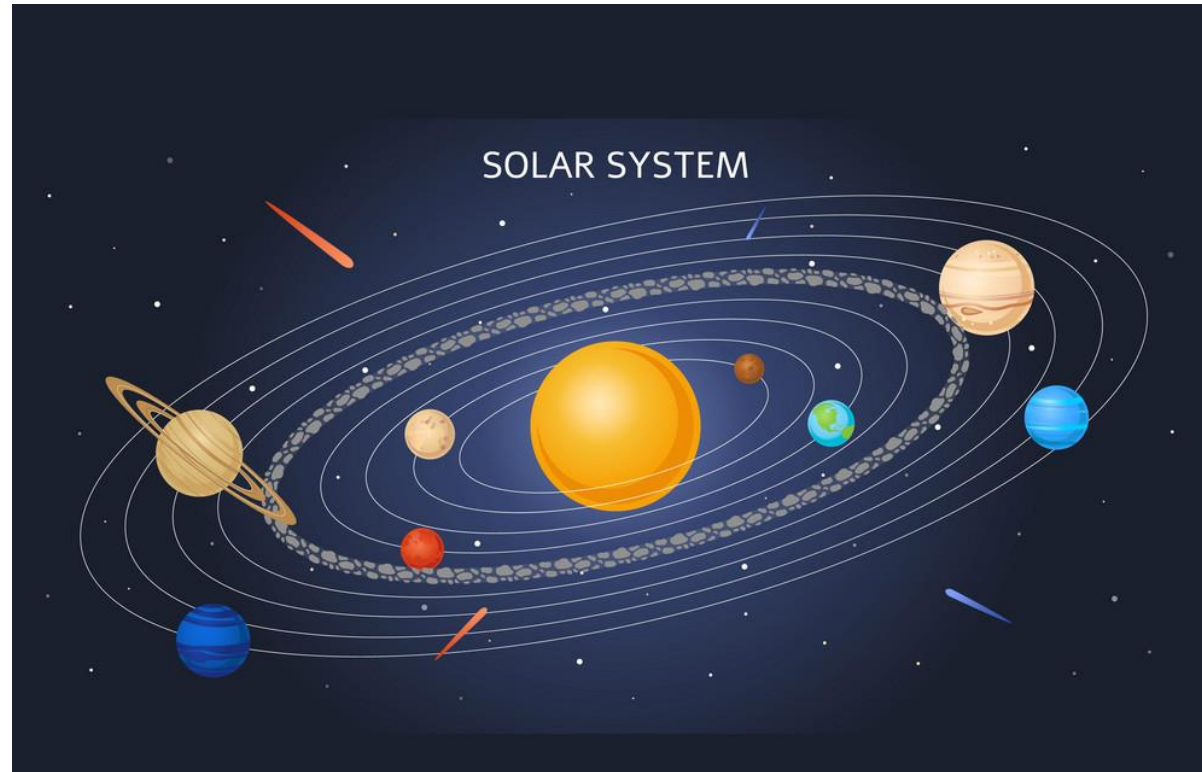
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Located at the centre of the solar system and influencing the motion of all the other bodies through its gravitational force is the Sun, which in itself contains more than 99 percent of the mass of the system.

The plane in which the Earth orbits the Sun is called ecliptic.

Visualised from top, all the eight planets are observed to move around the Sun counter-clockwise in an elliptical orbit.





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The eight planets can be divided into two distinct categories on the basis of their densities (mass per unit volume). The four inner, or **terrestrial, planets**—Mercury, Venus, Earth, and Mars—have rocky compositions and densities greater than 3 grams per cubic cm. The radiation and matter streaming from the Sun blew away most of the hydrogen, helium, water and other light gases and liquids from these planets. The materials left behind were the dense metals such as iron and other heavy, rock forming substances.

In contrast, the four outer planets, also called the **Jovian or Gas giant, planets**—Jupiter, Saturn, Uranus, and Neptune—are large objects with densities less than 2 grams per cubic cm; they are composed primarily of hydrogen and helium (Jupiter and Saturn) or of ice, rock, hydrogen, and helium (Uranus and Neptune).

The relatively small inner planets have solid surfaces, lack ring systems, and have few or no moons. The atmospheres of Venus, Earth, and Mars are composed of a significant percentage of oxidized compounds such as carbon dioxide. Among the inner planets, only Earth has a strong magnetic field, which shields it from the interplanetary medium. The four giant outer planets are much more massive than the terrestrial planets and have immense atmospheres composed mainly of hydrogen and helium. They have no solid surfaces, however, and their densities are so low that one of them, Saturn, would actually float in water. Each of the outer planets has a magnetic field, a ring system, and many known moons, with more likely to be discovered.

There is a belt of asteroids between the inner and outer planets.

## Solar System Data

Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (d=days) (y=years)	Period of Rotation at Equator	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm <sup>3</sup> )
SUN	—	—	27 d	—	1,392,000	333,000.00	1.4
MERCURY	57.9	88 d	59 d	0.206	4,879	0.06	5.4
VENUS	108.2	224.7 d	243 d	0.007	12,104	0.82	5.2
EARTH	149.6	365.26 d	23 h 56 min 4 s	0.017	12,756	1.00	5.5
MARS	227.9	687 d	24 h 37 min 23 s	0.093	6,794	0.11	3.9
JUPITER	778.4	11.9 y	9 h 50 min 30 s	0.048	142,984	317.83	1.3
SATURN	1,426.7	29.5 y	10 h 14 min	0.054	120,536	95.16	0.7
URANUS	2,871.0	84.0 y	17 h 14 min	0.047	51,118	14.54	1.3
NEPTUNE	4,498.3	164.8 y	16 h	0.009	49,528	17.15	1.8
EARTH'S MOON	149.6 (0.386 from Earth)	27.3 d	27.3 d	0.055	3,476	0.01	3.3





### **Definition of a planet:**

"A planet is a celestial body that is in orbit around the Sun, which has sufficient mass for its gravity to overcome the cohesive forces of the solid body and maintain hydrostatic equilibrium (spherical), which eliminated any body moving in an orbit close."

-August 24, 2006, during the 26th General Assembly of the IAU  
(International Astronomical Union)



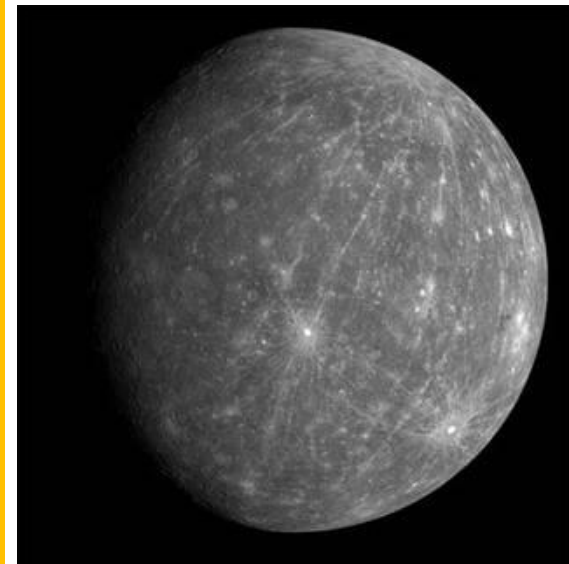
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## Mercury

is the closest planet to the Sun and the smallest planet in the solar system. Mercury travels around the Sun faster than any other planet because of its proximity. It has no satellite. It is difficult to see the planet clearly because of the Sun's glare. It appears for a brief time as a morning object in the eastern sky, rising just before sunrise. Then it can be briefly seen as an evening object in the western sky, setting just after sunset. Its cratered surface can experience temperatures upwards of 800 degrees Fahrenheit (426.7 degrees Celsius) because of its proximity to the sun. However, temperatures on the side facing away from the sun are cold - about -279 F (-173 C).

Mercury is the second densest planet in the solar system after Earth. The density of the Earth is due in part to gravitational compression; otherwise, Mercury would be denser. This is explained by the fact that the iron core of Mercury is relatively larger than that of the Earth, probably representing the majority of the planet. As a result, Mercury has a mantle (crust silicates), relatively thin. Mercury has a large iron core with a radius of 1800 to 1900 km. The envelope of silicates (similar to the crust and mantle terrestrial) is only 500 to 600 km. No people have ever gone to Mercury, but the first robotic spacecraft to visit Mercury was Mariner 10.





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## Venus

" the morning/evening star " our nearest (at 40 millions km away) planetary neighbour is like Earth in both size (6 378.14 km radius for the Earth, 6 051.8 km for Venus) and density. Its surface is dominated with volcanic features and is dotted with continent-like highlands and folded mountain belts. The cratered surface is hot with surface temperatures around 900 F (482 C). The atmosphere of Venus is made up mainly of carbon dioxide, and thick clouds of sulfuric acid completely cover the planet. The atmosphere of Venus is very hot and thick. You would not survive a visit to the surface of the planet - you couldn't breathe the air, you would be crushed by the enormous weight of the atmosphere, and you would burn up in surface temperatures high enough to melt lead. Studies suggest that although surface of the Venus has about 1000 relatively young craters, it does not have a heavily cratered terrain dominated by ancient impact structures like those of Moon, Mercury and Mars.



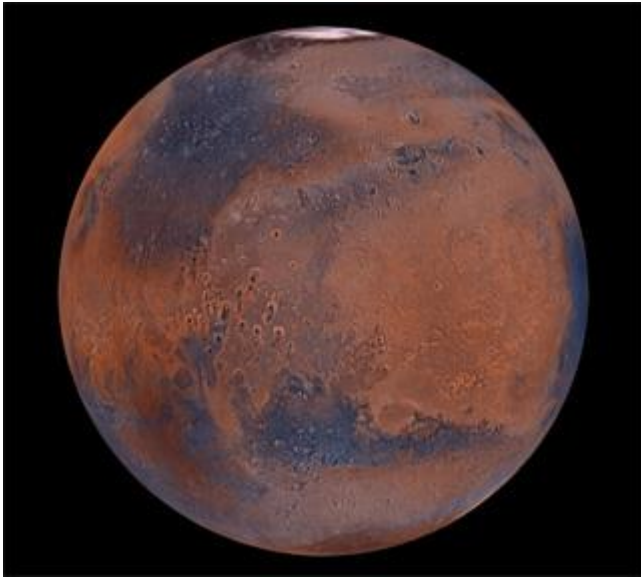
## Earth

also known as blue planet is a unique planet home to millions. It is the only planet delicately balanced by the conditions necessary for sustaining life. The third planet from the sun and the largest terrestrial planet, is the only planet known to host living beings and the only one known to have liquid water on its surface. The atmosphere, made of mostly nitrogen, oxygen and carbon dioxide, is crucial to Earth's ability to support life. Although the surface of the earth is mostly water, the planet also has large landmasses which harbor a stunning variety of ecosystems.



## Mars

the fourth planet from the sun, Mars, the Red Planet. The red color of the surface comes from iron oxide or rust in the soil. The topography is characterized by large volcanoes and deep valleys, and Mars experiences frequent planet-wide wind storms. Some of the surface features of Mars, such as dry river beds, hint to the possibility that water previously existed on the planet and may still flow under the surface. The carbon dioxide atmosphere is very thin on Mars, with only 1/100th the atmospheric pressure of Earth. The planet is colder than Earth, with surface temperatures ranging from -171 to 32 F (-113 to 0 C). The two moons of Mars are Phobos and Deimos. Recently, evidence of presence of water on Mars has been detected.





## Jupiter

is the largest planet in the solar system. It is approximately 143,000 kilometers (about 89,000 miles) wide at its equator. Jupiter is so large that all of the other planets in the solar system could fit inside it. More than 1,300 Earths would fit inside Jupiter.

Its atmosphere is made up of mostly hydrogen gas and helium gas, like the sun. The planet is covered in thick red, brown, yellow and white clouds. The clouds make the planet look like it has stripes.

One of Jupiter's most famous features is the Great Red Spot. It is a giant spinning storm, resembling a hurricane. At its widest point, the storm is about 3 1/2 times the diameter of Earth. Jupiter is very windy. Winds range from 192 mph to more than 400 mph. Jupiter has an extremely powerful magnetic field, like a giant magnet. Deep under Jupiter's clouds is a huge ocean of liquid metallic hydrogen. On Earth, hydrogen is usually gas. But on Jupiter, the pressure is so great inside its atmosphere that the gas becomes liquid. As Jupiter spins, the swirling, liquid metal ocean creates the strongest magnetic field in the solar system.

Jupiter has 53 named moons. Scientists have discovered 26 more. But those 26 moons do not have official names. Scientists now think Jupiter has 79 moons. The planet's four largest moons are Ganymede, Callisto, Io and Europa. The first mission to Jupiter was Pioneer 10, launched in 1972. From 1979 to 2007, eight NASA spacecraft studied Jupiter: Pioneer 10, Pioneer-Saturn, Voyager 1, Voyager 2, Ulysses, Galileo, Cassini and New Horizons. (The Ulysses, Cassini and New Horizons missions flew by Jupiter on their way to planets and locations farther in the solar system.) A new spacecraft named Juno is now orbiting Jupiter. NASA's Juno spacecraft launched in 2011 and arrived at Jupiter on July 4, 2016.



The Galileo spacecraft took this photo of Jupiter's Great Red Spot in 1996.



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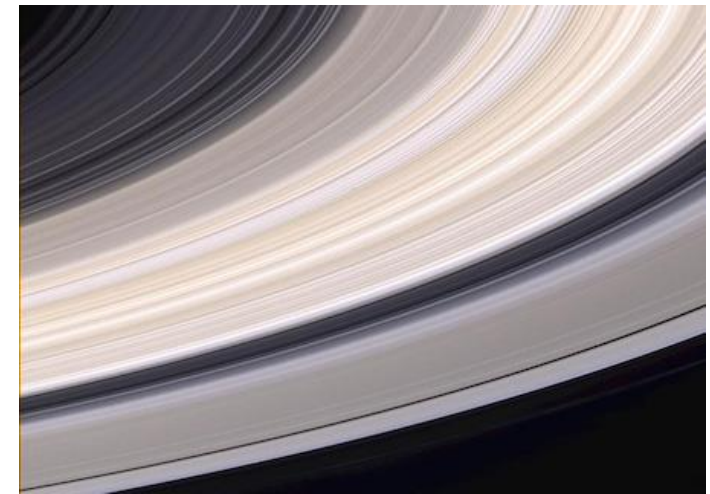
## Saturn

is the sixth planet from the Sun and the second largest planet in our solar system. Adorned with thousands of beautiful ringlets, Saturn is unique among the planets. Saturn's rings are thought 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 coated with another material such as dust. Saturn's ring system extends up to 175,000 miles (282,000 kilometers) from the planet, yet the vertical height is typically about 30 feet (10 meters) in the main rings. The main rings are A, B and C. Rings D, E, F and G are fainter and more recently discovered.

Like fellow gas giant Jupiter, Saturn is a massive ball made mostly of hydrogen and helium. At Saturn's center is a dense core of metals like iron and nickel surrounded by rocky material and other compounds solidified 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.

Currently Saturn has 53 confirmed moons with 29 additional provisional moons awaiting confirmation.

*This is a picture of Saturn and its moons Tethys and Dione. Voyager 1 took this picture as it passed by.*



*The Cassini spacecraft took this picture of Saturn's rings. You can see the grey and tan colors.*



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## Uranus

is the only giant planet whose equator is nearly at right angles to its orbit (A collision with an Earth-sized object may explain the unique tilt). Nearly a twin in size to Neptune, Uranus has more methane in its mainly hydrogen and helium atmosphere than Jupiter or Saturn. Methane gives Uranus its blue tint. Uranus has 27 known moons.

Discovered: March 13, 1781 by William Herschel. Voyager 2 flew past Uranus in 1986, giving us our first close view of the planet.

*The Hubble Space Telescope took this picture of Uranus. You can see bands and a dark spot in Uranus' atmosphere.*



## Neptune

is our solar system's windiest world. Winds whip clouds of frozen methane across the planet at speeds of more than 2,000 km/h (1,200 mph). Earth's most powerful winds hit only about 400 km/h (250 mph). Neptune is very similar to Uranus. It's made of a water, ammonia, and methane over an Earth-sized solid center. Its atmosphere is made of hydrogen, helium, and methane. The methane gives Neptune the same blue color as Uranus. Neptune has at least five main rings and four prominent ring arcs that we know of so far. Starting near the planet and moving outward, the main rings are named Galle, Leverrier, Lassell, Arago and Adams. Neptune has 14 known moons. Neptune's largest moon Triton was discovered on October 10, 1846, by William Lassell, just 17 days after Johann Gottfried Galle discovered the planet.

*Right: Voyager 2 image, taken in 1989, was the first to show Neptune's rings in detail.*

