

The Solar System and its Planets

Our Solar System is part of the Milky Way Galaxy. According to NASA, it currently consists of the Sun, 8 planets, 5 dwarf planets, and more than 200 moons.

The first four planets from the Sun are called the inner planets and are separated from the outer planets by the **asteroid belt**, a region between Mars and Jupiter that is primarily composed of irregularly shaped and sized asteroids.

Let's discuss all these celestial bodies one by one.

The Sun



Picture of the Sun taken by NASA's Solar Dynamics Observatory. Credit: NASA/SDO

The Sun is a yellow dwarf star and the center of our solar system. It is so massive that it constitutes nearly 99.8% of all the mass in the solar system, while 0.2% is only represented by the planets.

It is 4.6 billion years old, as old as our solar system. It is a big ball of gas composed of 92.1% hydrogen and 7.8% helium. The surface of the Sun is the coolest portion with temperatures of 5,600°C. The hottest temperatures can be observed in the core where temperatures can go as high as 15,000,000°C.

Distances in the solar system are based on the distance between the Sun and the Earth called **1 astronomical unit (AU)** which is equivalent to 150 million km.



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The Terrestrial Planets

1. Mercury



Picture of Mercury taken by NASA Visualization Technology Applications and Development (VTAD). Credit: <u>NASA</u>

Mercury is the innermost planet closest to the Sun and the smallest out of all planets, only slightly larger than the moon. It is the second densest planet after the Earth.

Despite being closest to the Sun, it is not the hottest planet in the solar system. Temperature changes during daytime and nighttime are extreme, with temperatures reaching 430°C during the day and -180°C at night. It has no known moons.

2. Venus



Picture of Venus captured by NASA's JLP-Caltech. Credit: NASA/JPL-Caltech



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Venus is the second planet from the Sun and the hottest planet in the solar system. Out of all the atmosphere-bearing planets, it has the densest atmosphere, composed primarily of CO₂.

Venus spins in the opposite direction (**retrograde motion**) compared to other planets. The longest-known lava channel in the solar system, **Baltis Vallis**, can be found here. It has no known moons.

3. Earth



Picture of Earth taken by NASA Earth Observatory. Credit: NASA/Earth Observatory

Earth is the third planet from the Sun and our home planet. As far as we know, it is the only planet in the solar system that is suitable for life due to the presence of liquid water on the surface. It has one moon, aptly named Moon.

We will discuss the formation of the Earth and how it moves in more detail in the next chapter. For more in-depth information on processes that occur on Earth, check out our <u>Earth Science</u> <u>reviewer</u>.

4. Mars



Picture of Mars taken by NASA's JPL-Caltech. Credit: NASA/JPL-Caltech

Mars is the fourth planet from the Sun and our closest neighbor. It is said that out of all the planets, Mars is the closest to being Earth-like.



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After the Earth, it is the second most explored planet in the solar system. It is also known as the "red planet" because of the presence of iron oxide in its rocks that give it a reddish hue.

The largest volcano in the solar system, **Olympus Mons**, can be found here. Expeditions on the surface of Mars showed evidence of the presence of water in the planet's early years. It has two known moons, Phobos and Deimos.

The Jovian Planets

5. Jupiter



Picture of Jupiter taken by NASA's JPL and the University of Arizona. Credit: NASA/JPL/University of Arizona

Jupiter is the fifth and largest planet in the solar system and the largest out of the four gas giants. It is mostly composed of gas and has a small solid inner core the size of Earth.

The colorful bands seen on the surface of Jupiter are the result of convective flows of gases. The light-colored areas represent warm, ascending material while the dark-colored areas represent the cold, sinking material.

The **Great Red Spot** is a very noticeable area on Jupiter's surface which actually represents the largest storm on the planet and the solar system. Jupiter has more than 75 known moons and a ring system.



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6. Saturn



Picture of Saturn taken by NASA's JPL. Credit: <u>NASA/JPL/Space Science Institute</u>

Saturn is the sixth and second-largest planet from the Sun. It also exhibits **the most spectacular ring system** out of all the gas giants.

Its 7 rings and thousands of ringlets are actually composed of rocks, ice, and other space debris. Like Jupiter, it is mostly composed of gas and has a small solid rocky core.

Aside from its ring system, it currently has 62 known moons and possibly more.

7. Uranus



Picture of Uranus captured by NASA's spacecraft Voyager 2. Credit: NASA

Uranus is the seventh planet from the Sun and is uniquely known as the "sideways planet" because of the sideways orientation of its axis, as opposed to the rest of the planets.

As a gas giant, it has a small rocky core and is mostly made up of gas and ice. It was **the first planet to be discovered using a telescope** in the 18th century. Although not as spectacular as Saturn's, it has a ring system and over 27 known moons.



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8. Neptune



Picture of Neptune taken by NASA's spacecraft Voyager 2. Credit: NASA

Neptune is the farthest planet from the Sun. As we all know by now, it is a gas giant and therefore, also has a rocky core and mostly gaseous composition.

It is known as the **"windiest planet" in the solar system** with wind speeds of up to 2,000 km/h. Like Jupiter, it has dark spots named Great Dark Spots where raging rotating storms occur. However, they are more short-lived than Jupiter's Great Red Spot.

It also has a ring system and around 14 known moons. Beyond Neptune is a vast donut-shaped region containing icy bodies called the Kuiper Belt. The icy bodies are called Kuiper Belt Objects (KBOs) or trans-Neptunian objects (TNOs). Some of these icy bodies are considered dwarf planets which we will discuss in more detail below.

The Dwarf Planets



The five dwarf planets in the Solar System (roughly to scale). Credit: JorisvS/Creative Commons



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According to the International Astronomical Union (IAU), to be classified as a planet, a celestial body must:

- 1. Be in orbit around the Sun
- 2. **Have sufficient mass to assume hydrostatic equilibrium** (Its gravitational pull must be strong enough to assume a rounded shape)
- 3. Have cleared the neighborhood around its orbit (It has to be the dominant gravitational body in its orbit and either attract or push away smaller bodies intersecting its orbit)

Celestial bodies that pass one or two conditions but fail the rest are called **dwarf planets**. As of 2020, there are five known dwarf planets.

- Pluto Pluto was considered as the 9th planet until stripped of its planet status in 2006 because it could not satisfy the third requirement– it did not "clear the neighborhood" as it revolved around the Sun. Its size is large enough for its gravitational force to maintain 5 known moons. It is located in the Kuiper Belt.
- 2. **Eris** Its diameter is nearly the same with Pluto's and together, they are considered as the two largest dwarf planets. It is located nearly 3 times farther than Pluto, extending beyond the Kuiper Belt. Before being named Eris, it was named 2003 UB313.
- 3. **Ceres** It is the largest object located in the asteroid belt found separating the inner and outer planets. It is also the smallest and the earliest known dwarf planet, being discovered in 1801.
- Haumea It is a football-shaped dwarf planet found in the Kuiper Belt beyond Neptune. Its distorted shape is attributed to its fast spin and is considered as one of the fastest rotating objects in our solar system.
- 5. **Makemake** Like Haumea, Makemake can be found along the Kuiper Belt. Before being designated as a dwarf planet, it was named 2005 FY9.



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