

THE SOLAR SYSTEM

Sun: 333,000 Earth masses
Diameter 1,392,000km
109 times the diameter of Earth

Mercury: 57.9 million km from the Sun
0.055 Earth masses

Venus: 108.2 million km from the Sun
0.815 Earth masses

Earth: 149.6 million km from the Sun

Mars: 227.9 million km from the Sun
0.107 Earth masses

Asteroid Ceres: 413 million km from the Sun
0.00015 Earth masses

Jupiter: 778.5 million km from the Sun
318 Earth masses

Saturn: 1.43 billion km from the Sun
95 Earth masses

Uranus: 2.87 billion km from the Sun
14.5 Earth masses

Neptune: 4.50 billion km from the Sun
17 Earth masses

Pluto: 5.9 billion km from the Sun
0.00218 Earth masses

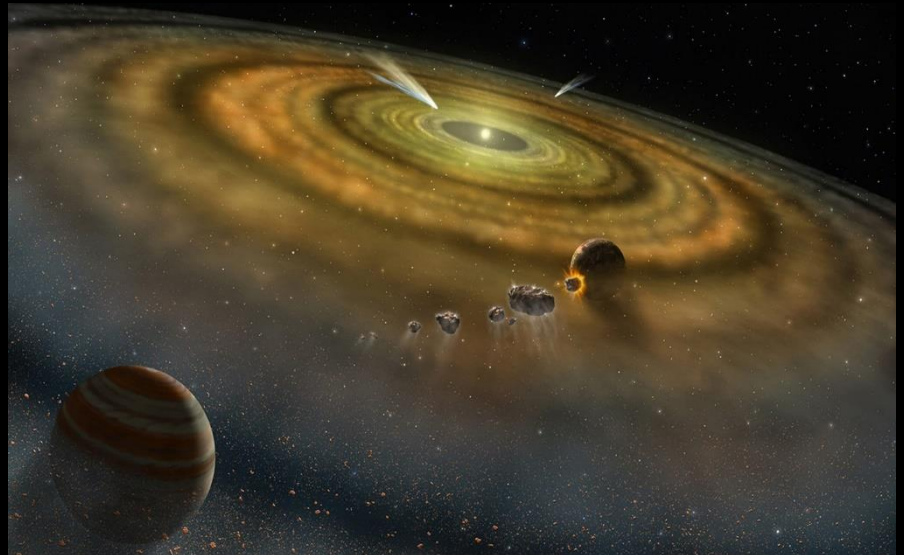
2003 UB/Eris: 67.7 billion km from the Sun
0.0028 Earth masses



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Some Interesting Solar System Information

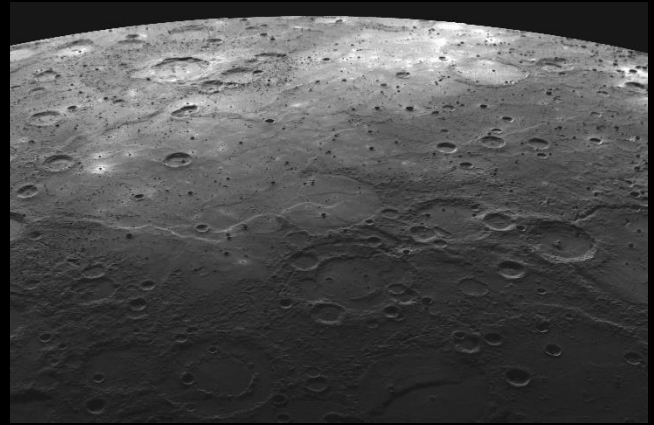
- The Solar System began forming about 4.6 billion years ago from the gravitational collapse of a small part of a giant gas and dust cloud. Some of the cloud materials were remnants scattered from supernova explosions of stars that existed long before our Sun formed.
- The initial gas and dust cloud was likely several light-years across and probably condensed into several gravitational pockets, potentially creating several other stars in addition to our Sun.
- In one of those pockets, vast quantities of gas collected in the centre, forming our Sun, while the rest flattened into a protoplanetary disc with a diameter of about 300 billion kilometres.
- The planets, moons, asteroids, and other small Solar System bodies formed within this protoplanetary disc.
- The planets formed by accretion from this disc, with dust and gas gravitationally coalescing to form larger bodies. The larger a proto-planet grew, the stronger its gravity field became and the more material it drew in. As the planets grew in size they eventually swept up all the gas and dust in their vicinity.
- The inner Solar System was too warm for volatile molecules, so only compounds with high melting points could form there, leading to the rocky terrestrial planets Mercury, Venus, Earth and Mars.
- The giant gas planets – Jupiter, Saturn, Uranus and Neptune - formed beyond the frost-line, where gas and icy compounds could remain far from the hot Sun.
- The process of planet formation took place over millions of years.
- The Sun formed when the centre of the collapsing cloud reached temperatures sufficient for nuclear reactions to begin, about 50 million years after the initial collapse. The Sun accounts for 99.86% of all the mass in the solar system.
- The Solar System has evolved considerably since its initial formation, with many moons forming later from circling discs of gas and dust or through captures and collisions.
- Our Solar System consists of the Sun, eight planets, dwarf planets, moons, asteroids, comets, and other celestial bodies plus gas and dust.



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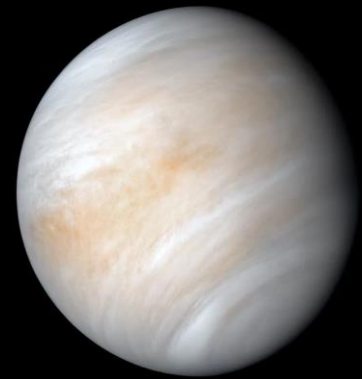
Mercury – rocky planet

- Mercury has the most eccentric orbit (oval or elliptical orbit) of all planets, with its distance from the Sun varying by about 24 million kilometres in a stretch elliptical orbit.
- Mercury experiences the most extreme temperature variations of any planet, ranging from -180°C at night to 430°C during the day.



Venus – rocky planet covered by thick cloud

- Venus is the hottest planet in the Solar System, despite Mercury being closer to the Sun.
- Venus rotates in the opposite direction to most planets, a phenomenon known as retrograde rotation. This is most likely due to a collision with another very large object early in Venus' formation.
- Venus is often called Earth's "sister planet" due to their similar size and mass. However, its extreme heat and atmospheric conditions make it essential impossible to support life, unlike Earth.
- Venus has a surface pressure 90 times greater than Earth's, equivalent to the pressure at a depth of 1 km in Earth's oceans.



Earth – small rocky planet with liquid water

- Earth is the fifth largest planet in the solar system.
- It is the largest of the inner, rocky planets - Mercury, Venus, and Mars.
- Its distance from the Sun allows Earth to maintain liquid water on its surface, unlike Venus (too hot) or Mars (too cold). This is referred to as the "Goldilocks" distance from the Sun. Not too hot and not too cold, just right for liquid water and life.
- Earth is the only planet in the solar system known to support life.
- Earth's slight axial tilt results in changing seasons, a feature not all planets share.
- Earth is the only known planet with an atmosphere containing 21% oxygen.
- Earth has one moon, which is relatively large compared to Earth's size. All other solar system moons are small compared to their parent planet.
- Earth has a strong magnetic field that protects it from dangerous solar radiation.

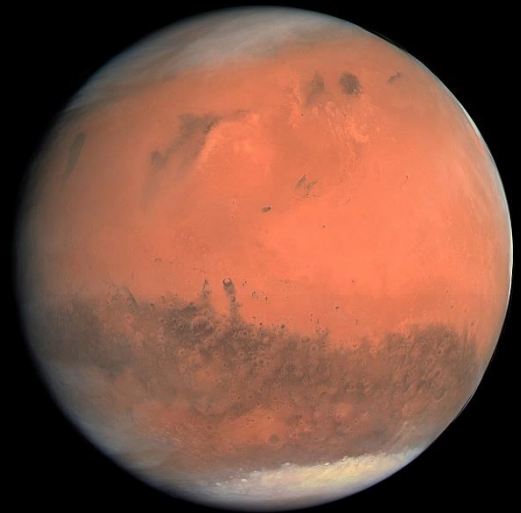


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- Earth is the only known planet with active plate tectonics, which contributes to its geological diversity and habitability.
- Earth is the only planet not named after a god or goddess from Roman or Greek mythology.

Mars – small rocky planet

- Mars is the fourth planet from the Sun and the second smallest planet in the solar system (after Mercury).
- Mars has a thin atmosphere composed mostly of carbon dioxide, nitrogen, and argon.
- This contrasts with Earth's oxygen-rich atmosphere and the thick atmospheres of gas giants like Jupiter and Saturn.
- Mars is often called the "Red Planet" due to its reddish appearance caused by iron oxide (rust) on its surface.
- It has diverse surface features including volcanoes, canyons, and polar ice caps, similar to Earth but on a larger scale.
- Mars has two small irregularly shaped moons: Phobos (Fear) and Deimos (Panic). They are believed to be captured asteroids.
- A Martian year is almost twice as long as Earth's, at 687 Earth days.
- Mars experiences extreme temperature variations, from about -140°C at the poles to 20°C at the equator during midday.
- While Mars does not have liquid water on its surface now, evidence suggests it had significant amounts in the past and was partially covered by a large shallow ocean across its northern hemisphere.
- It still has water ice at its poles and possibly underground at lower latitudes.
- Mars is considered one of the most likely places in the solar system (besides Earth) where life might have existed, or could potentially exist now.
- Mars is the only planet populated entirely by robots, with various rovers and landers exploring its surface.



The Asteroids – countless small rocky and frozen objects

- The asteroid belt is located between Mars and Jupiter, roughly 2.2 to 3.2 AU from the Sun.
- This contrasts with the planets, which have distinct orbital paths around the Sun.

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- Asteroids are primarily composed of rock and metals, similar to the terrestrial planets (Mercury, Venus, Earth, Mars). However, unlike planets, asteroids are relatively small and irregular in shape.
- The largest known asteroid, Ceres, is only about 940 km in diameter. This is much smaller than even the smallest planet, Mercury (4,879 km diameter).
- There are millions of asteroids in the solar system, with over 1.1 million known as of 2023. This is in stark contrast to the eight recognized planets.
- Asteroids are remnants from the early solar system that never coalesced into a planet.
- Planets, on the other hand, formed through accretion of vast quantities of asteroid-like material.
- Most asteroids lack an atmosphere, unlike the planets which have varying degrees of atmospheric composition.
- Asteroids have very weak gravity due to their small size, unlike planets which have significant gravitational fields.
- Several asteroids have been visited by spacecraft, including Ceres and Vesta by NASA's Dawn mission.

Jupiter – a gas giant planet

- Jupiter is the largest planet in our solar system - more than twice as massive as all other planets combined.
- Jupiter's Great Red Spot is a giant storm that has been raging for at least 350 years and is so large that three Earths could fit inside it.
- Jupiter has the shortest day of any planet, rotating once every 9 hours and 55 minutes.
- Jupiter has 95 officially recognized moons as of July 2023.
- Jupiter's moon Ganymede is the largest moon in the solar system, even larger than the planet Mercury.
- Jupiter's magnetic field is the strongest of any planet in the solar system.
- Jupiter's atmosphere is made mostly of hydrogen and helium, like the Sun.
- Jupiter may have a core about the size of Earth, but made of heavy elements.
- The planet is named after the king of the Roman gods.



Saturn – a gas giant planet

- Saturn is the second-largest planet in our solar system, after Jupiter. Nine Earths could almost span Saturn's diameter.

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- Saturn has the most extensive ring system of any planet, stretching out more than 120,700 km from the planet, but are only about 20 meters thick.
- Saturn is the least dense planet in the Solar System, with a density less than water.
- A day on Saturn is only 10 hours and 34 minutes long, giving it the second-shortest day of any planet in the solar system.
- Saturn takes about 29.5 Earth years to complete one orbit around the Sun.
- Saturn has 146 confirmed moons, more than any other planet in our solar system.
- Titan, Saturn's largest moon, is bigger than the planet Mercury and is the only moon in our solar system with a dense atmosphere.
- Saturn's upper atmosphere is divided into bands of clouds, mostly composed of ammonia ice.
- The planet has oval-shaped storms like Jupiter, including a hexagonal-shaped storm at its north pole.
- Four spacecraft have visited Saturn: Pioneer 11, Voyager 1, Voyager 2, and Cassini-Huygens.
- The planet is named after the Roman god of agriculture. In Greek mythology, known as Cronus.
- Saturn's rings are made mostly of chunks of ice and small amounts of carbonaceous dust.
- Scientists believe Saturn's core might be 2-3 times the size of Earth, composed of iron and rocky material.
- Saturn is visible to the naked eye and has been known since ancient times.



Uranus – a gas and ice giant planet

- Uranus is the seventh planet from the Sun and the third-largest planet in our solar system.
- It is known as an "ice giant" due to its composition of ices like water, ammonia, and methane.
- Uranus has a unique tilt - it rotates on its side with its axis nearly parallel to its orbit, possibly due to a collision with an Earth-sized object long ago.
- This unusual tilt causes extreme seasons that last for about 20 years each.

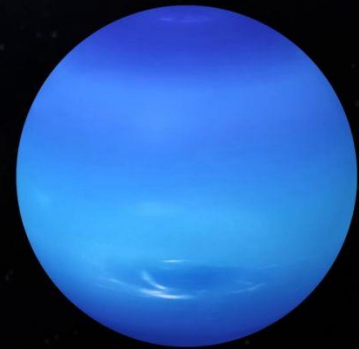


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- A day on Uranus lasts about 17 Earth hours, but a year is 84 Earth years.
- Uranus has 27 known moons, most named after characters from the works of William Shakespeare and Alexander Pope.
- The planet has a faint ring system, discovered in 1977.
- Uranus appears blue-green due to methane in its atmosphere, which absorbs red light.
- It is the coldest planet in our solar system, with minimum atmospheric temperatures of -224°C .
- Uranus was the first planet discovered using a telescope, by William Herschel in 1781.
- Only one spacecraft, Voyager 2, has visited Uranus, flying by in 1986.
- The planet's atmosphere is composed mainly of hydrogen (83%), helium (15%), and methane (2%).
- Uranus' diameter is about 51,100 km, making it four times wider than Earth.

Neptune – a gas and ice giant planet

- Neptune is the eighth and most distant planet from the Sun in our solar system, orbiting at a distance of about 4.5 billion kilometers.
- Neptune was the first planet discovered through mathematical predictions rather than direct observation. It was discovered in 1846 by Johann Galle, based on calculations by Urbain Le Verrier and John Couch Adams.
- Neptune is about four times wider than Earth, with a diameter of 49,528 kilometers. It is the fourth-largest planet by diameter and the third most massive, with a mass 17 times that of Earth.
- Neptune's atmosphere is composed mainly of hydrogen, helium, and methane. The methane gives Neptune its striking blue colour by absorbing red light.
- Neptune has the fastest winds in the solar system, reaching speeds of up to 2,100 kilometers per hour. It also has large storms, including the Great Dark Spot, similar in form to Jupiter's Great Red Spot.
- Neptune has a faint ring system composed of five main rings made of dust and ice particles.
- Neptune has 14 known moons. The largest, Triton, is unique because it orbits Neptune in the opposite direction to the planet's rotation. Triton is also geologically active, with geysers that spew nitrogen ice.
- Neptune has a rapid rotation, with a day lasting about 16 hours. However, it takes 165 Earth years to complete one orbit around the Sun.
- Neptune is one of the coldest planets in the solar system, with average temperatures around -200°C .
- The only spacecraft to visit Neptune was NASA's Voyager 2, which flew by the planet in 1989, providing the first close-up images and data about Neptune and its moons.

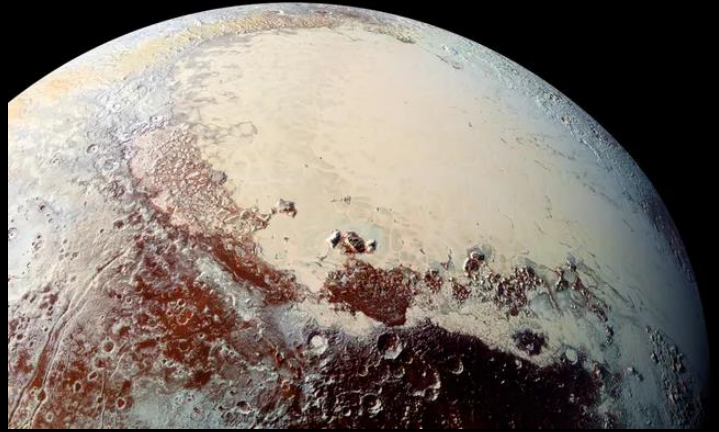


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- Neptune is not visible without a telescope due to its great distance from Earth. It appears as a tiny, faint blue-green disc through small telescopes.

Pluto – a dwarf planet

- Pluto was once considered the ninth planet but was reclassified as a dwarf planet in 2006.
- It was discovered in 1930 by Clyde Tombaugh at the Lowell Observatory in Arizona.
- It is smaller than Earth's moon, with a diameter of about 2,377 km.
- Pluto has five known moons, named after other mythological figures associated with the underworld - Charon, Nix, Hydra, Kerberos, and Styx. Charon is so large compared to Pluto that they are sometimes referred to as a double dwarf-planet system.
- A year on Pluto lasts 248 Earth years. Its day is about 6.4 Earth days long.
- Pluto's orbit is highly elliptical and tilted, sometimes bringing it closer to the Sun than Neptune.
- The surface of Pluto is extremely cold, with temperatures around -230°C .
- Pluto has a thin atmosphere that expands when it moves closer to the Sun and collapses when farther away.
- The New Horizons spacecraft provided our first close-up images of Pluto in 2015, revealing a complex and varied frozen surface of nitrogen and carbon dioxide ices.
- Pluto has a large heart-shaped glacier on its surface called Sputnik Planitia.
- Despite its small size, Pluto has mountains, valleys, plains, and even possible ice volcanoes.
- Pluto is part of the Kuiper Belt, a region of the outer solar system beyond Neptune's orbit containing many small icy bodies.
- If you stood on Pluto, the Sun would appear as an extremely bright star rather than a disc.



Eris – a frozen dwarf planet

- Eris is the most massive known dwarf planet in our solar system, even slightly more massive than Pluto.
- It was discovered in 2005 by a team led by Mike Brown at the California Institute of Technology.
- Eris is named after the Greek goddess of discord and strife.



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- Its discovery played a crucial role in the debate that led to Pluto's reclassification as a dwarf planet in 2006.
- Eris is about 2,326 km in diameter, making it slightly smaller in size than Pluto despite being more massive.
- It orbits the Sun at an average distance of about 68 astronomical units (AU), more than twice as far as Pluto.
- One year on Eris lasts about 557 Earth years due to its distant orbit.
- Eris has one known moon called Dysnomia, named after the daughter of the goddess Eris in Greek mythology.
- The surface of Eris is extremely cold, with temperatures estimated to be around -230°C .
- Eris has a highly reflective surface, even more so than fresh snow on Earth, likely due to a layer of frozen methane.
- Its orbit is highly elliptical and tilted, taking it from about 38 AU to 97 AU from the Sun.
- At its farthest point from the Sun, Eris' atmosphere is thought to freeze and collapse onto its surface.
- It is so far away that it takes over 10 hours for sunlight to reach Eris.

