

Astronomy

Astronomy, the study of the universe, is focused on expanding your knowledge of the things God made that are not on this earth. We will look at our solar system including the sun, planets, and asteroids to name a few. Remember what it says in Genesis 1, “God created the Heavens and the Earth”. God has placed all things in the sky for us and learning about what is out there is very important. I find that astronomy helps me to enjoy the night time. Knowing what I am looking at in the night sky and looking for things that appear once in while makes the night sky intriguing. God created the “sun to rule the day and the moon to rule the night”. This gives me comfort that he has taken care of me around the clock and no matter where I am and what I am doing God is taking care of me. Let’s start with our quest to learn about what God made that is part of our universe.

Level 1

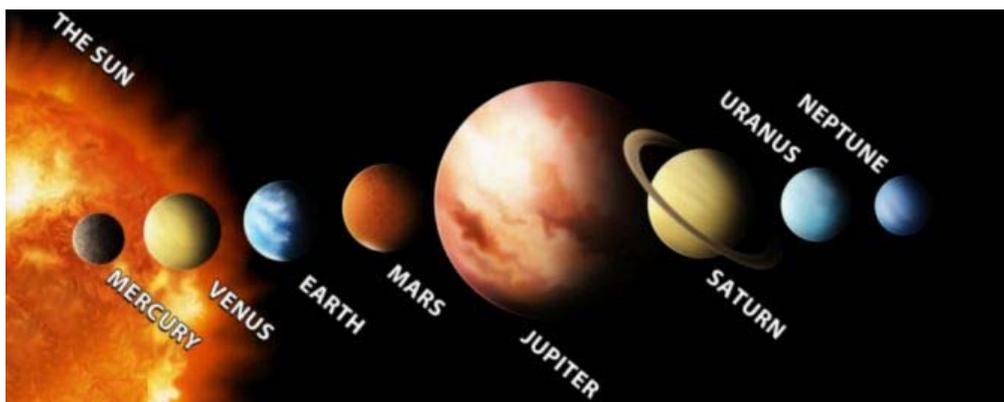
Solar system, Planets, Sun, Asteroid belt, Kuipier belt and Oort cloud

The solar system

When you think of the solar system you think of the primary bodies that make it up, the planets that orbit our sun. The solar system also consists of moons, comets, asteroids, minor planets, dust and gas.

Everything in the solar system orbits or revolves around the sun. The sun contains around 98% of all the material in the solar system. The larger an object is, the more gravity it has. Because the sun is so large, its powerful gravity attracts all the other objects in the solar system towards it. At the same time, these objects, which are moving very rapidly, try to fly away from the sun, outward into the emptiness of outer space. The result of the planets trying to fly away, at the same time that the Sun is trying to pull them inward is that they become trapped half-way in between. They orbit around the sun in perfect balance.

The **Sun** is the star at the center of the Solar System. It is almost perfectly spherical and consists of hot plasma interwoven with magnetic fields. It has a diameter of about 1,392,684 km (865,374 mi), around 109 times that of Earth, and its mass (1.989×10^{30} kilograms, approximately 330,000 times the mass of Earth) accounts for about 99.86% of the total mass of the Solar System. The majority of the Sun's mass consists of hydrogen, while the rest is mostly helium. It also has a very small percentage of other elements including oxygen, carbon, neon and iron, among others.



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10 Need-to-Know Things About Our Solar System:

1. God created our solar system.
2. Our solar system is made up of the sun and everything that travels around it. This includes eight planets and their natural satellites such as Earth's moon; dwarf planets such as Pluto and Ceres; asteroids; comets and meteoroids
3. The sun is the center of our solar system. It contains almost all of the mass in our solar system and exerts a tremendous gravitational pull on planets and other bodies.
4. The four planets closest to the Sun - Mercury, Venus, Earth, and Mars - are called the terrestrial planets because they have solid, rocky surfaces.
5. Two of the outer planets beyond the orbit of Mars - Jupiter and Saturn - are known as gas giants; the more distant Uranus and Neptune are called ice giants.
6. Most of the known dwarf planets exist in an icy zone beyond Neptune called the Kuiper Belt, which is also the point of origin for many comets.
7. Many objects in our solar system have atmospheres, including planets, some dwarf planets and even a couple moons.
8. Our solar system is located in the Orion Arm of the Milky Way Galaxy. There are most likely billions of other solar systems in our galaxy. And there are billions of galaxies in the universe.
9. We measure distances in our solar system by Astronomical Units (AU). One AU is equal to the distance between the sun and the Earth, which is about 150 million km (93 million miles).
10. NASA's twin Voyager 1 and Voyager 2 spacecraft are the first spacecraft to explore the outer reaches of our solar system.

The Planets

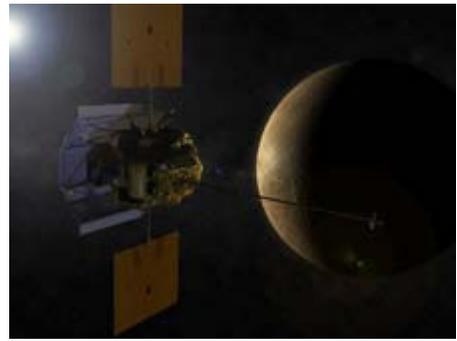
The perfect place to start learning about astronomy is to look close to home and start by learning about the planets. Since we all inhabit the Earth, a planet, what better place to start. We will start closest to the sun and move outward away from the sun. Lets get started.

Mercury:

1. Mercury is the smallest planet in our solar system - only slightly larger than the Earth's moon.
2. It is the closest planet to the sun at a distance of about 58 million km (36 million miles) or 0.39 AU.
3. One day on Mercury (the time it takes for Mercury to rotate or spin once) takes 59 Earth days. Mercury makes a complete orbit around the sun (a year in Mercury time) in just 88 Earth days.

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- Mercury is a rocky planet, also known as a terrestrial planet. Mercury has a solid, cratered surface, much like Earth's moon.
- Mercury's thin atmosphere, or *exosphere*, is composed mostly of oxygen (O₂), sodium (Na), hydrogen (H₂), helium (He), and potassium (K).
- Mercury has no moons.
- There are no rings around Mercury.
- Only two spacecraft have visited this rocky planet: Mariner 10 in 1974-5 and MESSENGER, which flew past Mercury three times before going into orbit around Mercury in 2011.
- Daytime Temperatures can reach 430 degrees Celsius (800 degrees Fahrenheit) and drop to -180 degrees Celsius (-290 degrees Fahrenheit) at night. It is unlikely life (as we know it) could survive on this planet.
- Standing on Mercury's surface at its closest point to the sun, the sun would appear more than three times larger than it does on Earth.



MESSENGER: First to orbit Mercury.

Venus:

- Venus is only a little smaller than Earth.
- Venus is the second closest planet to the sun at a distance of about 108 million km (67 million miles) or 0.72 AU.
- One day on Venus lasts as long as 243 Earth days (the time it takes for Venus to rotate or spin once). Venus makes a complete orbit around the sun (a year in Venusian time) in 225 Earth days.
- Venus is a rocky planet, also known as a terrestrial planet. Venus' solid surface is a cratered and volcanic landscape.
- Venus' thick and toxic atmosphere is made up mostly of carbon dioxide (CO₂) and nitrogen (N₂), with clouds of sulfuric acid (H₂SO₄) droplets.
- Venus has no moons.
- There are no rings around Venus.
- More than 40 spacecraft have explored Venus. The Magellan mission in the early 1990s mapped 98 percent of the planet's surface.
- The planet's extreme high temperatures of almost 480 degrees Celsius (900 degrees Fahrenheit) make it seem an unlikely place for life as we know it.
- Venus spins backwards (retrograde rotation) when compared to the other planets. This means that the sun rises in the west and sets in the east on Venus.



Magellan: Mapping Venus

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Earth:

1. Earth is the third planet from the sun at a distance of about 150 million km (93 million miles) or one AU.
2. One day on Earth takes 24 hours (this is the time it takes the Earth to rotate or spin once). Earth makes a complete orbit around the sun (a year in Earth time) in about 365 days.
3. Earth is a rocky planet, also known as a terrestrial planet. What makes Earth different from the other terrestrial planets is that it is also an ocean planet: 70 percent of the Earth's surface is covered in oceans.
4. The Earth's atmosphere is made up of 78 percent nitrogen (N_2), 21 percent oxygen (O_2) and 1 percent other ingredients -- the perfect balance for us to breathe and live. Many planets have atmospheres, but only Earth's is breathable.
5. Earth has one moon.
6. Earth has no rings.
7. Many orbiting spacecraft study the Earth from above as a whole system and together aid in understanding our home planet.
8. Earth is the perfect place for life.
9. Earth's atmosphere protects us from incoming meteoroids, most of which break up in our atmosphere before they can strike the surface as meteorites.



Spacecraft study Earth from above.

Mars:

1. Mars is a cold desert world.
2. It is half the diameter of Earth and has the same amount of dry land.
3. Like Earth, Mars has seasons, polar ice caps, volcanoes, canyons and weather, but its atmosphere is too thin for liquid water to exist for long on the surface.
4. There are signs of ancient floods on Mars, but evidence for water now exists mainly in icy soil and thin clouds.

Jupiter:

1. Jupiter, the most massive planet in our solar system -- with dozens of moons and an enormous magnetic field -- forms a kind of miniature solar system.
2. Jupiter does resemble a star in composition, but it did not grow big enough to ignite.
3. The planet's swirling cloud stripes are punctuated by massive storms such as the Great Red Spot, which has raged for hundreds of years.
4. Jupiter's appearance is a tapestry of beautiful colors and atmospheric features. Most visible clouds are composed of ammonia. Water vapor exists deep below and can sometimes be seen through clear spots in the clouds.
5. The planet's "stripes" are dark belts and light zones created by strong east-west winds in Jupiter's upper atmosphere.

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Saturn:

1. Adorned with thousands of beautiful ringlets, Saturn is unique among the planets.
2. All four gas giant planets have rings -- made of chunks of ice and rock -- but none are as spectacular or as complicated as Saturn's.
3. Like the other gas giants, Saturn is mostly a massive ball of hydrogen and helium.

Uranus:

1. 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 Uranus' unique tilt.
2. 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.

Neptune:

1. Neptune is the last of the hydrogen and helium gas giants in our solar system.
2. More than 30 times as far from the sun as Earth, the planet takes almost 165 Earth years to orbit our sun.
3. In 2011 Neptune completed its first orbit since its discovery in 1846.

Dwarf Planets:

What is a planet? This has been asked for a long time and most recently they have taken the planet status away from Pluto. Our solar system's planet count has soared as high as 15 before it was decided that some discoveries were different and should be called asteroids.

There was disagreement in 1930 when Pluto was added as our solar system's ninth planet. The debate flared again in 2005 when Eris -- about the same size as Pluto -- was found deep in a zone beyond Neptune called the Kuiper Belt. Was it the 10th planet? Or are Eris and Pluto examples of an intriguing, new kind of world?

Dwarf planets: The International Astronomical Union decided in 2006 that a new system of classification was needed to describe these new worlds, which are more developed than asteroids, but different than the known planets. Pluto, Eris and the asteroid Ceres became the first **dwarf planets**. Unlike planets, dwarf planets lack the gravitational muscle to sweep up or scatter objects near their orbits. They end up orbiting the sun in zones of similar objects such as the asteroid and Kuiper belts.

Our solar system's planet count now stands at eight.

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Comets:

Comets are cosmic snowballs of frozen gases, rock and dust roughly the size of a small town. When a comet's orbit brings it close to the sun, it heats up and spews dust and gases into a giant glowing head larger than most planets. The dust and gases form a tail that stretches away from the sun for millions of kilometers.

Asteroids and the Asteroid Belt:

Asteroids are rocky, airless worlds that orbit our sun, but are too small to be called planets. Tens of thousands of these "minor planets" are gathered in the main asteroid belt, a vast doughnut-shaped ring between the orbits of Mars and Jupiter. Asteroids that pass close to Earth are called Near-Earth Objects (NEOs).

The Kuiper Belt:

Further out, beyond the orbit of the minor planet Pluto, sits another belt known as the Kuiper Belt. Like the Asteroid Belt, the Kuiper Belt is also made up of thousands, possibly even millions of objects too small to be considered planets. A few of these objects, like Pluto, are large enough that their gravity has pulled them into a sphere shape.

These objects are made out of mostly frozen gas with small amounts of dust. They are often called dirty snowballs. However, you probably know them by their other name... comets.

The Oort Cloud:

The Oort Cloud is not really a cloud. It is a mass of a trillion or so comets which circle the Sun at a great distance. The Oort Cloud extends 13,950,000,000,000 miles from the Sun.

Unlike the Kuiper Belt, the comets in the Oort Cloud circle the Sun in every direction. They do not stay on the flat disk. These objects break the rules of the Solar System and create a sphere of comets around the Sun.

Beyond The Oort Cloud

The Sun's solar winds continue pushing outward until they finally begin to mix into the interstellar medium, becoming lost with the winds from other stars. This creates a sort of bubble called the Heliosphere. Scientists define the boundaries of the Solar System as being the border of the Heliosphere, or at the place where the solar winds from the Sun mix with the winds from

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other stars.

The Heliosphere extends out from the Sun to a distance of about 15 billion miles, which is more than 160 times further from the Sun than is the Earth. Around the year 2013 the Voyager space craft entered the Heliosphere. Scientists were not sure when this happened but they think in the year 2014 that the space craft was in fact leaving our solar system.