

Scale in the Solar System

In 1969, millions of people watched as humans visited the Moon for the first time. Since then, many astronauts have visited the area of space that's just outside Earth's atmosphere. We've even built the International Space Station, which circles Earth and allows astronauts to live and do research in space! We have also explored more distant areas of the solar system using probes—spacecraft without people on board. However, humans have never set foot anywhere else in the solar system. Technology that helps humans travel and survive in space has improved since that first trip to the Moon—so why haven't we traveled to any other planets? The answer lies in size and distance. Compared to the rest of our solar system, Earth is just a tiny dot surrounded by a whole lot of empty space.

Objects in the Solar System Come in Different Sizes

Earth is just one object in the group of objects we call our solar system. Our solar system includes the sun, the planets that move around the sun, and the moons that move around the planets. Some of the objects in our solar system, like the sun and the planet Jupiter, are so big that they're hard to imagine. Others aren't very big at all: some moons are only 3 or 4 kilometers all the way around!

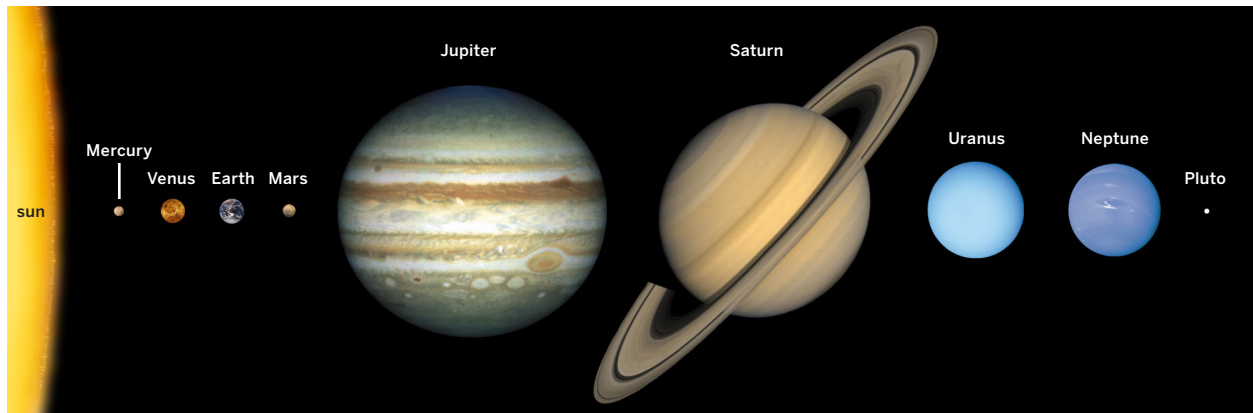
The sun is by far the biggest object in our solar system: it's so big that about 1.3 million Earths could fit inside it! If the sun were the size of a basketball, Earth would be the size of a grain of rice and Mercury would be the size of a pinhead. Even planets that are much bigger than Earth, like Jupiter and Saturn, would only be about the size of table-tennis balls.



In the night sky we can see objects in our solar system, like planets, and objects outside our solar system, like stars.

There are eight planets in our solar system, and they vary widely in size. Planets close to the sun are smaller, while planets far from the sun tend to be larger. In comparison with the rest of the planets, Earth is near the middle: it's the third planet in distance from the sun and the fifth-largest planet in size. The smallest planet in our solar system is Mercury—if Earth were hollow, about 18 Mercurys would fit inside. The largest planet in our solar system is Jupiter. It's so big that more than 1,000 Earths could fit inside!

Many of the planets in our solar system have moons—objects that travel around planets. Earth has one Moon, which you sometimes see in the night sky and during the day as well. If Earth were hollow, about 49 Moons would fit inside. Mars has two moons, and Jupiter and Saturn have many more than that: Jupiter has at least 63 moons and Saturn has 62, but scientists are still identifying more. Most moons aren't very big, but even moons vary a lot in size. Ganymede, a moon of Jupiter, is the largest moon in our solar system. It's larger than the planet Mercury!



The planets in our solar system come in a variety of sizes, but they are all much smaller than the sun. To show the sizes of the planets accurately, this illustration shows them much closer together than they really are.

Different Planets Are Different Distances from the Sun

The objects in our solar system don't just vary in size; each is also a different distance from the sun. The closest planet to the sun is Mercury; it's about 57 million kilometers from the sun. That may seem pretty far, but it's nothing considering how big the solar system is and how far away some of the other planets are. The farthest planet from the sun is Neptune—it's 4.5 *billion* kilometers from the sun. The distance of each planet from the sun makes a big difference in its climate and whether it can support life. Planets that are close to the sun, like Mercury and Venus, get a lot of energy from the sun and are too hot to be habitable. Planets that are very far from the sun, like Uranus and Neptune, get much less energy from the sun and are much too cold to be habitable. On these planets, water exists only as ice. Earth is about 149 million kilometers from the sun, which is good news for living things. Earth can support life partly because it has liquid water—and it has liquid water because it's just the right distance from the sun.

Since all the planets in the solar system (including Earth) are always moving around the sun, the distances between them are always changing. When scientists send spacecraft out

to explore other planets, they must think about where each planet will be at a certain time and when it will be easiest to reach. Even when our closest neighbor planets are as close to Earth as they can get, they're still very far away: Earth's neighbor planet Mars is so far away that it would take 6 months to get there by rocket. Other planets are much farther from Earth than Mars is—a spacecraft launched from Earth would take about 12 years to reach Neptune!

With all this empty space around us, it's no wonder humans haven't traveled very far from Earth. Sending people into space and bringing them back safely is complicated: scientists must take into account the amount of fuel needed to stay in space for months or years at a time, the weight of all the food and equipment astronauts need for a long trip, the way the human body might react to conditions on other planets, and lots of other important information. Still, many people are working on solving these problems in hopes of sending humans to other planets someday. The National Aeronautics and Space Administration (NASA) currently estimates that humans may make it to Mars around the year 2030.