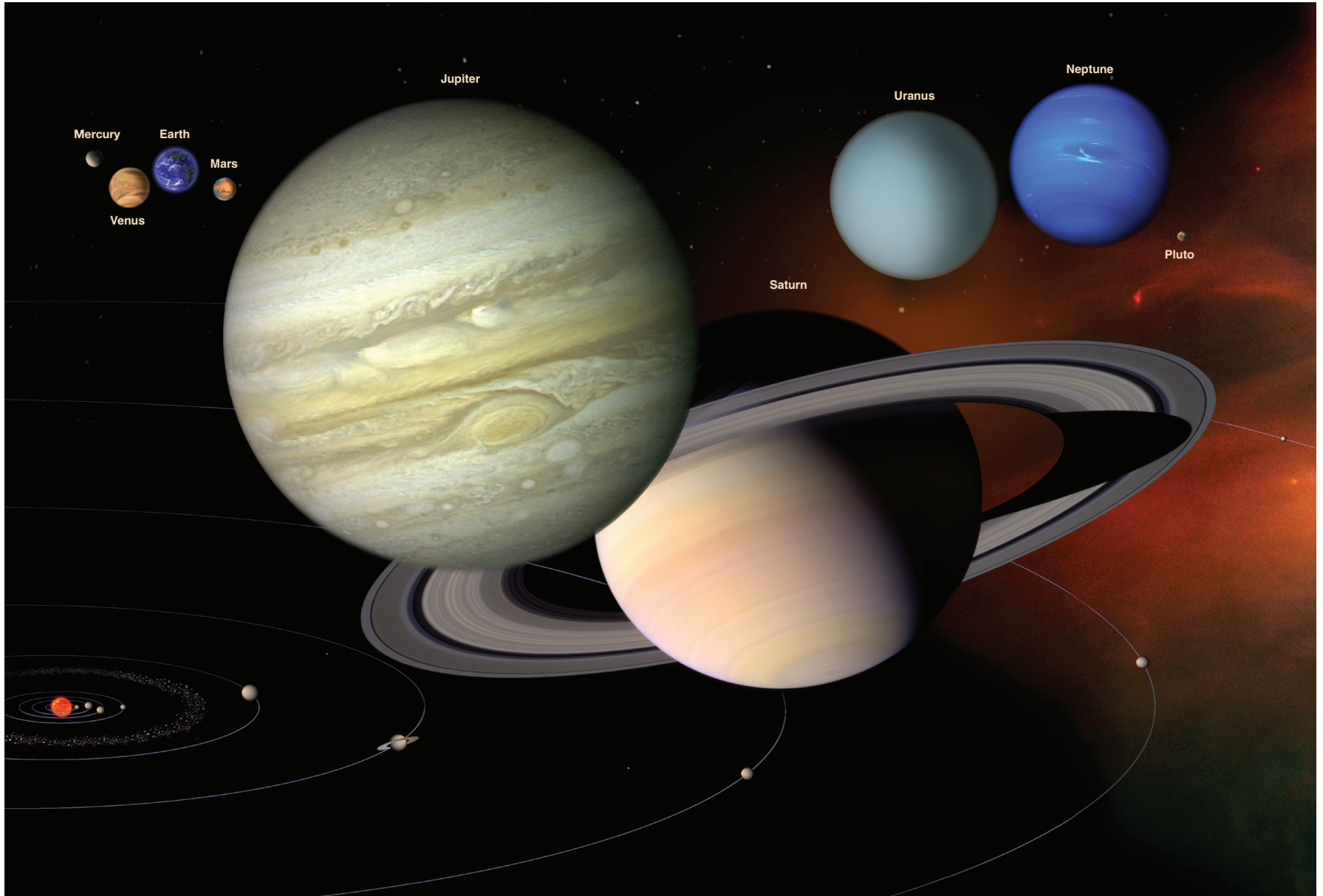


Our Solar System





Humans have gazed upon and tried to understand the cosmos for thousands of years. Ancient civilizations placed great emphasis on careful astronomical observation, building impressive monuments that were used to observe the skies. Stories were created about the objects in the heavens and many different names were given to them. Ancient Greek astronomers were among the first to leave a written record of their attempts to explain the cosmos. For them, the universe was Earth, the Sun, the Moon, the stars, and five glowing points of light that move among the stars. The Greeks named the five points of light after their gods. The later Romans named the five bright objects after their own gods — Mercury, Venus, Mars, Jupiter, and Saturn — and these are the names astronomers use today. Planetary features are named by the International Astronomical Union, founded in 1919. For more information about names, consult the Gazetteer of Planetary Nomenclature website at planetarynames.wr.usgs.gov.

Ancient observers believed that the Sun and all the other stars revolved around Earth. Astronomers came to realize that this Earth-centered model did not account for the motions of the planets. With the development of a Sun-centered model, our understanding of the solar system and the universe deepened. In the early 17th century, Galileo Galilei's discoveries using the recently invented telescope strongly supported the Sun-centered model. With the telescope as a tool, planetary moons, the rings of Saturn, and three more planets were eventually discovered: Uranus (in 1781), Neptune (1846), and Pluto (1930). Telescopes also aided in the discovery of asteroids and the study of comets.

The four planets closest to the Sun — Mercury, Venus, Earth and Mars — are called the terrestrial planets because they have solid rocky surfaces. The four outer planets beyond the orbit of Mars — Jupiter, Saturn, Uranus, and Neptune — are called gas giants. Tiny, distant Pluto has a solid surface covered with ice.

Earth's atmosphere is primarily nitrogen and oxygen. Mercury has no atmosphere, while Venus has a thick atmosphere of mainly carbon dioxide. Mars' carbon dioxide atmosphere is extremely thin. The gas giants Jupiter, Saturn, Uranus, and Neptune are mostly composed of hydrogen and helium. When Pluto is near the Sun, it has a thin atmosphere, but when Pluto travels to the outer parts of its orbit, the atmosphere freezes.

Moons, rings, and magnetic fields characterize the planets. There are 153 known natural satellites (moons) orbiting the planets, and they are not all alike. One moon (Saturn's Titan) has a thick atmosphere; another has active volcanoes (Jupiter's Io). Rings are an intriguing planetary feature. From 1659 to 1977, Saturn was thought to be the only planet with rings. NASA's Voyager missions to the outer planets showed that Jupiter, Uranus, and Neptune also have ring systems. Most of the planets have magnetic fields that extend into space and form a magnetosphere around each planet. These magnetospheres rotate with the planet, sweeping charged particles with them.

How big is our solar system? To think about the large distances involved, we use a cosmic ruler based on the astronomical unit (AU). One AU is the distance from Earth to the Sun, which is about 150 million kilometers or 93 million miles. To envision the Sun in the Milky Way galaxy, think of a ship moving through the ocean. The area of the Sun's influence stretches far beyond the planets, forming a giant bubble called the heliosphere. The enormous bubble of the heliosphere is created by the solar wind, a stream of charged gas blowing outward from the Sun. As the Sun orbits the center of the Milky Way, the bubble of the heliosphere moves also, creating a bow shock — like a ship in water — ahead of it in interstellar space as it crashes into the interstellar gases. The area where the solar wind is suddenly slowed by pressure from gas between the stars is called the termination shock.

A spacecraft that reached the termination shock would be able to measure the slowing effect, and that is exactly what happened when Voyager 1, traveling at a speed of 3.6 AU per year, began sending unusual data to Earth in November and December 2003. In May 2005, NASA confirmed that Voyager 1, 26 years after its launch, had entered the vast, turbulent expanse where the Sun's influence wanes — at about 94 AU, approximately 13 billion kilometers (8.7 billion miles) from the Sun. This is the solar system's final frontier. Voyager 1 is anticipated to have electrical power to continue to send data until at least 2020, when it may actually have traveled all the way through the last of the Sun's magnetic region and will enter an interstellar environment. It will be thousands of years before Voyager exits the region of the solar system's enormous Oort Cloud.

In 2004, President George W. Bush announced an exciting new Vision for Space Exploration that includes sustained robotic and human exploration of the solar system and beyond. It begins with robotic exploration of Earth's Moon with an orbiter and then a lander, with a human return to the Moon by 2018. The Moon would be a testbed for technologies to support human exploration of the Moon, Mars, and beyond.

As we explore the universe, we wonder: Are there other planets where life might exist? Are we alone? Only recently have astronomers had the tools to detect large planets around other stars in other solar systems using ground- and space-based telescopes.

FAST FACTS

Body	Equatorial Radius		Mean Distance from the Sun		Moons*
	km	mi	km, millions	mi, millions	
Sun	695,500	432,200	—	—	—
Mercury	2,440	1,516	57.91	35.98	0
Venus	6,052	3,760	108.21	67.24	0
Earth	6,378	3,963	149.60	92.96	1
Moon	1,737.4	1,079.6	**	**	—
Mars	3,397	2,111	227.94	141.63	2
Jupiter	71,492	44,423	778.41	483.68	62
Saturn	60,268	37,449	1,426.73	886.53	47
Uranus	25,559	15,882	2,870.97	1,783.94	27
Neptune	24,764	15,388	4,498.25	2,795.08	13
Pluto	1,180	733	5,906.38	3,670.05	1***

*Known moons as of November 2005.

**Mean Earth–Moon distance: 384,400 kilometers or 238,855 miles.

***In October 2005, NASA announced that Hubble Space Telescope scientists had found two possible additional moons of Pluto.

ABOUT THE ILLUSTRATION

The planets are shown in the correct order of distance from the Sun, the correct relative sizes, and the correct relative orbital distances. The sizes of the bodies are greatly exaggerated relative to the orbital distances. The faint rings of Jupiter, Uranus, and Neptune are not shown.

FOR MORE INFORMATION

solarsystem.nasa.gov/planets/profile.cfm?Object=SolarSys
solarsystem.nasa.gov/education/