Topic Page: Planets

Definition: **planet** from *Astronomy Encyclopedia*

Large, non-stellar body orbiting the Sun or another star and shining only by reflected light. Planets may be either rocky in composition, such as Mercury, Venus, Earth and Mars, or mainly gaseous, such as Jupiter, Saturn, Uranus and Neptune. Nine major planets exist in our Solar System, together with thousands of minor planets or asteroids. The name is Greek in origin, meaning 'wandering star'. *See also* PLANET X

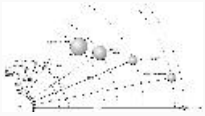

Image from: **solar system** in *The Macmillan Encyclopedia*

Summary Article: **planet**
From *The Columbia Encyclopedia*

[Gr.,=wanderer], a large nonluminous body of rock or gas that orbits the sun or another star, has a rounded shape due to gravity, and has cleared its orbit of smaller objects. The term, once limited to any of the eight solid, nonluminous bodies (also called major planets) that revolve around the sun, has been extended to include similar bodies discovered revolving around other stars. The term planet sometimes has been used to include dwarf planets and asteroids (or minor planets); it does not include comets and meteoroids (see meteor. See also planetary science and planetary system, as well as the table entitled Major Planets of the Solar System.

Classification of the Sun's Major Planets

The major planets are classified either as inferior, with an orbit between the sun and the orbit of Earth (Mercury and Venus), or as superior, with an orbit beyond that of Earth (Mars, Jupiter, Saturn, and Uranus, Neptune. Pluto, long regarded after its discovery in 1930 as the ninth planet, was gradually recognized as a Kuiper belt, or transneptunian, object (see comet), and in 2006 was reclassified by astronomers as a dwarf planet. Any dwarf planet beyond the orbit of Neptune is now classified as a plutoid.

On the basis of their physical properties the planets are further classified as terrestrial or Jovian. The terrestrial planets—Mercury, Venus, Earth, and Mars—resemble Earth in size, chemical composition, and density. Their periods of rotation range from about 24 hr for Mars to 249 days for Venus. The Jovian planets—Jupiter, Saturn, Uranus, and Neptune—are much larger in size and have thick, gaseous atmospheres and low densities. Their periods of rotation range from about 10 hr for Jupiter to 15 hr for Neptune. This rapid rotation results in polar flattening of 2% to 10%, giving the planets an elliptical appearance.

Recognition of the Planets

Identification of the Solar Planets

The ancient Greeks applied the term *planet* to the five major planets then known—Mercury, Venus, Mars, Jupiter, and Saturn—as well as to the sun and moon; all these bodies were observed to move back and forth against the background of the apparently fixed stars and to shine with a steady light. In the Ptolemaic system the earth was thought to lie at rest in the center of the universe while the planets moved about it in a complicated scheme of circles. The heliocentric, or sun-centered, Copernican system, introduced in the 16th cent., viewed the planets, including the earth, as revolving about the sun; the moon was viewed as a natural satellite of the earth. At the start of the 17th cent.

Johannes Kepler refined the Copernican model by showing that the orbits of the planets around the sun were elliptical rather than circular.

With the development of the telescope other planets became visible. Uranus, detected in 1781 by Sir William Herschel, was the first planet discovered in modern times. Neptune was discovered in 1846 as the result of a mathematical analysis of the irregularities in the motion of Uranus, and the dwarf planet Pluto, whose existence was predicted from the perturbations of both Uranus and Neptune, was found in 1930. In addition to the major planets, the telescope has revealed thousands of minor planets, or asteroids, which orbit the sun in a bandlike cluster between Mars and Jupiter; the largest of these, the dwarf planet Ceres, was also the first discovered (1801), and was regarded as a planet for many years. Additional minor planets have been discovered since 1992 beyond the orbit of Neptune in the Kuiper belt; at least one of these transneptunian objects, Eris, has a diameter (1,500 mi/2,400 km) slightly larger than that of Pluto. In 2016 researchers reported that peculiarities of the orbits of a number of the most distant known Kuiper belt objects would be best explained by the existence of a ninth planet with about 10 times the mass of Earth and an orbit that is 20 times farther from the sun than that of Neptune.

Discovery of the Extrasolar Planets

Although speculation concerning the existence of extrasolar planets (or exoplanets) and planetary systems dates back to antiquity, it was not until the last decade of the 20th cent. that astronomical tools and techniques made their detection possible. Because stars are so distant and bright and an extrasolar planet, no matter how large, is relatively small and dim, it cannot be seen or photographed directly. Its presence may be inferred from a periodic wobble in the spectrum of a target star's frequencies. This wobble, produced by gravitational influences, causes tiny shifts in the star's frequencies that are caught by telescopes and analyzed to yield information on the body affecting the star. Another technique that proved fruitful in 1999 is the use of a telescope to record the dimming of light from a star when a planet's orbit carries it between the star and the earth.

Spurred on by the discovery of three bodies orbiting a pulsar by radio astronomers in 1992, the first extrasolar planet orbiting a sunlike star was detected in 1995. Located in the constellation Pegasus, about 40 light-years from earth, the planet—called 51 Pegasi—has about half the mass of Jupiter and is so close to the star that it has a surface temperature of about 1,000 degrees Celsius and completes its orbit in only four days. By the end of the decade, more than two dozen extrasolar planets were detected, including three orbiting the star Upsilon Andromedae—the first multiplanet extrasolar planetary system—that were discovered in 1999. By 2016 the number of known exoplanets exceeded 3,000, and more that 550 multiplanet systems had been identified. It is now estimated that planets are more common than stars, that some 40% of sunlike stars have planetary systems, and that roughly one quarter of all stars have potentially habitable planets.

The *CoRoT* (launched 2006) and *Kepler* (launched 2009) space telescopes, especially the latter, significantly increased the number of known possible exoplanets. *Kepler* had by early 2011 identified more than 50 near-earth-sized planets that were located in the habitable zone. In 2014, Kepler scientists announced the discovery of a habitable-zone planet (Kepler 186f) with a radius estimated to be 10% larger than the earth's, that orbited a cool dwarf star with four other planets; because of its size, Kepler 186f was believed to be a rocky planet with the potential to have liquid water.

The overwhelming majority of exoplanets discovered by *Kepler* have been super-Earths (1.2–1.9 times

the size of the earth's radius) or sub-Neptunes (1.9–3.1 times bigger than the earth's radius); planets in this range are not found in solar system. Of the discovered rocky planets that are much larger than the earth, many are up to 10 times more massive (one, Kepler 10c, is 17 times as massive). Other known extrasolar planets are giant gas planets with masses ranging from one half to five times that of Jupiter, the largest of the solar planets. Many exoplanets have orbits that are highly elliptical rather than only slightly so, are closer to their star than the earth is to the sun, and have orbital periods ranging from three days to more than four years. In addition, the ages of the extrasolar planets differ from one another and from that of the solar planets; the oldest planet, discovered in the globular cluster M4 in 2003, is believed to have been formed 12.7 billion years ago, within a billion years of the origin of the universe and 8 billion years before the earth. Because these data are so different from that of the solar planets, planetary scientists are rethinking the accepted theories of planetary formation.

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