



San Francisco

# Sidewalk Astronomers

We stop people on sidewalks and let them see the craters of the Moon, the moons of Jupiter, the rings of Saturn, or the spots on the Sun. For just a moment, they have a personal connection with the universe around them, and sometimes life seems a little better after that.

The Sidewalk Astronomers was founded in 1968 in San Francisco by John Dobson. You can find more information about the Sidewalk Astronomers, John Dobson, astronomy, telescopes and telescope making classes on the Sidewalk Astronomers web page. We have an email announcement list to let you know about sidewalk and other astronomy events in the Bay Area.

Web site: [www.sfsidewalkastronomers.org](http://www.sfsidewalkastronomers.org)

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## A little about our most frequent targets:

The **MOON** is small, only about a quarter the size of the Earth. The Moon is 225,745 miles from Earth. If you drove to the Moon at 70 miles per hour, it would take you 135 days to get there. The Moon is actually moving away from Earth at a rate of 1.5 inches per year. The surface area of the Moon is 14,658,000 square miles, or 9.4 billion acres. Only about 59 percent of the Moon's surface is visible from Earth. The Moon is not round, but egg-shaped with the large end pointed towards Earth. The Earth rotates at about 1,000 mph at the equator. By comparison, the Moon rotates about 10 mph.

The phases of the Moon are caused by the relative positions of the Moon and Sun in the sky. For example, New Moon occurs when the Sun and Moon are quite close together in the sky. Full Moon occurs when the Sun and Moon are at nearly opposite positions in the sky – which is why a Full Moon rises about the time of sunset, and sets about the time of sunrise. First and Last Quarters occur when the Sun and Moon are about 90 degrees apart in the sky. In fact, the two half-Moon phases are called First Quarter and Last Quarter because they occur when the Moon is, respectively, one- and three-quarters of the way around the sky (i.e., along its orbit) from New Moon.

**JUPITER** is the largest planet in the solar system. Its diameter is 88,846 miles (142,984 kilometers), more than 11 times that of Earth, and about one-tenth that of the Sun. It would take more than 1,000 Earths to fill up the volume of the giant planet.

Jupiter is the fifth planet from the Sun. Its mean (average) distance from the Sun is about 483,600,000 miles (778,300,000 kilometers), more than five times Earth's distance. Jupiter takes

12 years to go around the Sun. The Great Red Spot is not red – rather, it is a pale oval, and is surprisingly difficult to see. Jupiter has 63 moons, and the four major moons are Io, Europa, Ganymede and Callisto. These four moons were discovered by Galileo on January 7, 1610, through a homemade telescope, and are visible through amateur telescopes.

**SATURN** is the sixth planet in the solar system, orbiting the Sun between Jupiter and Uranus. Its average distance from the Sun is over 850 million miles (Earth's is 93 million miles). Saturn's orbit is nearly a circle. Its closest approach to the Sun is around 840 million miles, while its furthest distance is around 930 million miles.

The most obvious feature of Saturn is its planetary ring system. Saturn has seven main ring sections labeled A thru G. These ring sections consist of over 3,000 individual rings of various sizes, shapes, and compositions. Between some of the ring sections appears to be a "gap," but these gaps actually contain some ring material. The largest and most obvious "gap" is the Cassini Division, between ring sections A and B. A smaller gap, known as the Encke Division, is found in the outer part of ring section A. Of the three main ring sections, B is the brightest, followed by A, and then by the almost translucent C section.

Saturn is visibly flattened at the poles, due to its very fast rotation on its axis. It is also the least dense of any planet in the solar system, having a density less than that of water. Like Jupiter, Saturn's atmosphere is composed mostly of hydrogen and helium, with only trace amounts of other elements. The fierce wind on the planet blows at astounding speeds, peaking anywhere from 600 miles per hour up to 1,100 mph in some areas. This wind, blowing through the cloud features, creates the effect of faint color bands circling the planet.

Saturn has 47 natural satellites. Six or seven of these are visible through amateur telescopes.

**MARS** is the fourth planet from the Sun. Its average distance from the Sun is 141,635,349 miles (227,940,000 kilometers). Its distance from the Earth varies from about 35 million miles when closest to about 250 million miles at its farthest. A year on Mars lasts about 686 days, almost twice as long as an Earth year. A day on Mars is only about 37 minutes longer than a day on Earth. Though Mars is only half the radius of Earth, it has no oceans, and so it has about the same amount of land area as Earth.

Mars is more like Earth than any other body in the Solar System. It has an atmosphere, though about 100 times thinner than Earth's. Mars has clouds and weather, as well as frequent dust storms that can sometimes cover the entire planet. Many millions of years ago, Mars was likely wet like Earth with lakes and perhaps even oceans. Its rotation axis is tilted nearly the same as Earth's, so it has seasons like we do – though they last twice as long due to the longer year. Seasons on Mars are more extreme than on Earth because Mars orbits the Sun more like an ellipse, causing it to move closer and farther from the Sun during its year.

Mars has two moons, Phobos and Deimos. Both are much smaller than our Moon, though they can be spotted through large amateur telescopes when Mars is close to Earth.

The **SUN** is our nearest star. About 93 million miles away, its light takes a little more than eight minutes to reach us. The Sun is a giant ball of burning hydrogen, generating heat and light through nuclear fusion deep within its core.

From time to time, magnetic fields generated with the Sun intersect at one point on its surface, and get "knotted up" with each other. At that point on the Sun's surface, the upwelling of hot gas from below is constricted, and that spot cools down. Even though that location is still very hot, it is cooler than its surroundings, and so it looks like a dark spot when viewed through solar telescopes. We call this magnetic "storm" a sunspot. Sunspots follow an 11-year cycle, with many visible at the peak and few visible when the cycle is at its ebb. This cycle is caused by the way in which the magnetic fields inside the Sun turn and twist.

**Never** view the Sun without proper equipment, or you will permanently damage your eyesight. The Sidewalk Astronomers use special solar telescopes and filters designed for safe Sun viewing.

For more information, visit The Nine Planets website: [www.nineplanets.org](http://www.nineplanets.org).