Lunar phase

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"Moon phase" redirects here. For the manga and anime series, see Tsukuyomi: Moon Phase.


Animation of the Moon as it cycles through its phases, as seen from the Northern Hemisphere. The apparent wobbling of the Moon is known as libration. The apparent change in size is due to the eccentricity of the lunar orbit.

A **lunar phase** or **phase of the moon** is the appearance of the illuminated (sunlit) portion of the Moon as seen by an observer, usually on Earth. The lunar phases change cyclically as the Moon orbits the Earth, according to the changing relative positions of the Earth, Moon, and Sun. The half of the lunar surface facing the Sun is always sunlit, but the portion of this illuminated hemisphere that is visible to an observer on Earth can vary from about 100% (full moon) to 0% (new moon). The lunar terminator is the boundary between the illuminated and unilluminated hemispheres. Aside from some craters near the lunar poles such as Shoemaker, all parts of the Moon see around 14.77 days of sunlight followed by 14.77 days of "night" (there is no permanently "dark side" of the Moon).

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Overview


The lunar phase depends on the Moon's position in orbit around the Earth and the Earth's position in orbit around the sun. This diagram (*not to scale*) looks down on Earth from north. Both Earth and the Moon's orbit are rotating counter-clockwise. Sunlight (*yellow arrows*) is

coming in from the right. One can see, for example, that the full moon will always rise at sunset and that the waning crescent moon is high overhead around 9:00 am local time.

Lunar phases are the result of looking at the illuminated half of the Moon from different viewing geometries; they are *not* caused by the shadow of the Earth or umbra falling on the Moon's surface (this occurs only during a lunar eclipse).

The Moon exhibits different phases as the relative position of the Sun, Earth and Moon changes, appearing as a full moon when the Sun and Moon are on opposite sides of the Earth and as a new moon (dark moon) when they are on the same side. The phases of full moon and new moon are examples of syzygies, which occur when the Earth, Moon, and Sun lie (approximately) in a straight line. The time between two full moons (a Lunar month) is about 29.53 days[1] (29 days, 12 hours, 44 minutes) on average (hence, the concept of the time frame of an approximated month was derived). This synodic month is longer than the time it takes the Moon to make one orbit around the Earth with respect to the fixed stars (the sidereal month), which is about 27.32 days.[1] This difference is caused by the fact that the Earth-Moon system is orbiting around the Sun at the same time the Moon is orbiting around the Earth.

The actual time between two syzygies or two phases is quite variable because the orbit of the Moon is elliptic and subject to various periodic perturbations, which change the velocity of the Moon. When the moon is closer to the earth, it moves faster; when it is farther, it moves slower. The orbit of the Earth around the Sun is also elliptic, so the speed of the Earth also varies, which also affects the phases of the Moon.[2]

It might be expected that once every month when the Moon passes between Earth and the Sun during a new moon, its shadow would fall on Earth causing a solar eclipse. Likewise, during every full moon one might expect the Earth's shadow to fall on the Moon, causing a lunar eclipse. Solar and lunar eclipses are not observed every month because the plane of the Moon's orbit around the Earth is tilted by about five degrees with respect to the plane of Earth's orbit around the Sun (the plane of the ecliptic). Thus, when new and full moons occur, the Moon usually lies to the north or south of a direct line through the Earth and Sun. Although an eclipse can only occur when the Moon is either new or full, it must also be positioned very near the intersection of Earth's orbit plane about the Sun and the Moon's orbit plane about the Earth (that is, at one of its nodes). This happens about twice per year, and so there are between four and seven eclipses in a calendar year. Most of these are quite insignificant; major eclipses of the Moon or Sun are rare.

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