

## All about occultation

The location of the second full Moon of November, or Blue Moon as it is sometimes known (see *Scope on the Skies*, January 1999 to learn more about this nickname) near the planet Saturn sets up a pair of celestial events known as an *occultation*. An occultation, or hiding, occurs when the Moon, in this case, blocks our view of a planet or star other than our Sun. Knowing when an occultation will occur allows astronomers to make very interesting observations and discoveries.

On the evening of November 30, the full Moon passes between the Earth and Saturn, occulting, or hiding, Saturn from view to observers across the United States. Then, during the pre-dawn hours of December 28, the nearly full Moon passes between the Earth and Saturn, again blocking our view of the planet.

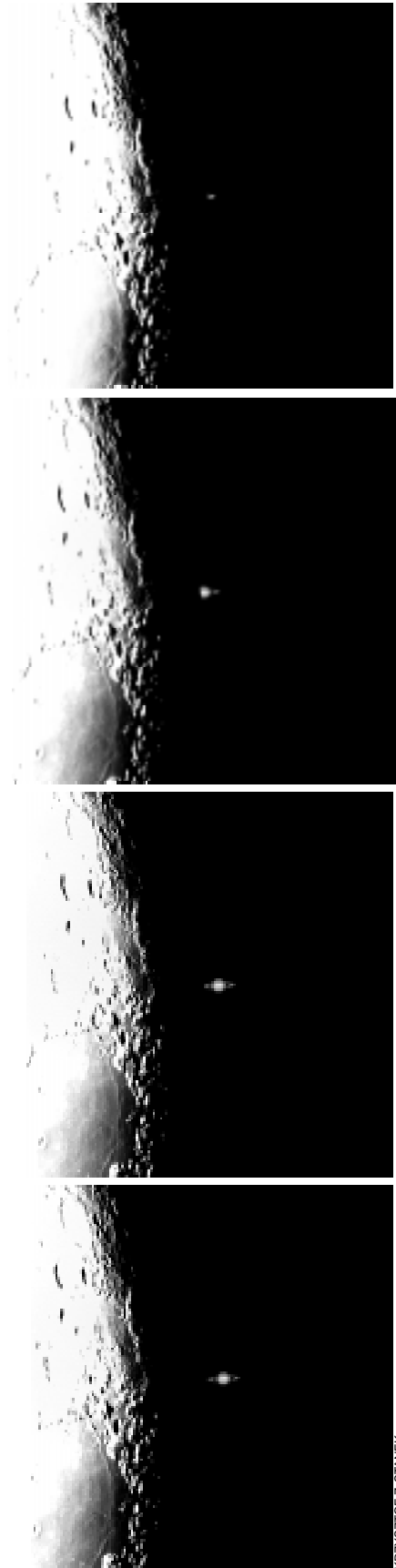
Your location on Earth affects your ability to view an occultation, just as it affects your ability to view an eclipse. The further you are from the *centerline* (the path an object traces along the surface of the Earth), the shorter the duration of the event. However, unlike an eclipse, viewing near the edge of the occultation path offers a unique opportunity to observe what is called a *grazing occultation*. During a grazing occultation, the star or planet can appear to be skimming along the profile of the Moon, as it alternately disappears behind the lunar mountains and then reappears moments later in the lunar valleys between the mountain peaks.

### Partial solar eclipse

On December 14, the new Moon will pass between the Earth and the Sun, creating a partial solar eclipse. During this particular eclipse, the Moon will be far enough away from the Earth that it will not block the Sun completely when it passes in front of it. Instead,

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the Moon will exhibit an *annulus*, or ring of fire encircling it.

The centerline of the eclipse will start in the Pacific Ocean and eventually cross Central America, ending in Costa Rica. As with all eclipses, viewers who are near the centerline will observe an eclipse that is longer in duration and more pronounced in coverage of the Sun than viewers who are farther away from the centerline. Depending on the weather, this eclipse should be visible from the western half of the United States.

## Penumbral lunar eclipse

Eclipses occur in pairs, which means that there will be an eclipse of the Moon during the following full Moon late in the evening of December 29 and the early morning hours of December 30. This eclipse will be visible from the entire United States but unfortunately it will not be particularly noticeable because the path the Moon follows takes it through the outer and fainter part of the Earth's shadow known as the *penumbra*.

## A pair of meteor showers

During November, the annual meteor shower known as the Leonids, will radiate out from the constellation Leo. This meteor shower, with an average rate of 10 or so meteors per hour, has an interesting history of reaching meteor storm proportions of thousands of meteors per hour approximately every 33 years. While 1999 was the 'scheduled' year for the meteor storm, the years surrounding the storm year also have a chance of an increased frequency of meteors. Typical of all annual meteor showers is the time span during which the meteor shower occurs. The Leonids last for about one week, starting on November 14, and ending around the 21st. The peak date for the most active display has been calculated to be the early morning hours of the 17th through the evening of the 18th.

Less than one month later, the Geminid meteor shower will brighten our skies with an average hourly rate of about 120 meteors per hour. While the meteor shower lasts from the December 7 to the 17th, it reaches its peak on the 14th. This is a particularly good meteor shower to observe as the

radiant, within the Gemini Twins, rises during early evening, allowing for meteor shower viewing nearly all night.

## Celestial events

- Two full Moons (Blue Moon) in November
- 11/18 Leonid meteor shower peaks
- 12/14 Geminid meteor shower peaks
- 12/14 Annular solar eclipse
- 12/21 2:21 P.M. EST December solstice
- 12/30 Penumbral lunar eclipse

## Visible planets

- Mercury seen in morning skies over the eastern horizon during the first two weeks of the month. Best morning viewing opportunity of the year.
- Venus rises just ahead of the sun and is very low over the eastern horizon.
- Mars is over the southwestern horizon at sunset.
- Jupiter rises in the east about two hours after sunset and is visible the rest of the night.
- Saturn rises in the east at about sunset and is visible the rest of the night.

## Moon phases

	November	December
Full Moon	11/02	—
Last quarter	11/10	12/07
New Moon	11/16	12/14
First quarter	11/22	12/22
Full Moon	11/30	12/30

## Internet resources

**International Occultation Timing Association:**

[www.lunaro occultations.com/iotaliotandx.htm](http://www.lunaro occultations.com/iotaliotandx.htm)

**Occultation of Saturn Images:** [cfa-www.harvard.edu/~kstanek/Saturn](http://cfa-www.harvard.edu/~kstanek/Saturn)

**Map of solar eclipse path:** [sunearth.gsfc.nasa.gov/eclipse/OH/OH2001.html#SE2001Dec14A](http://sunearth.gsfc.nasa.gov/eclipse/OH/OH2001.html#SE2001Dec14A)

**Blue Moon:** [www.obliquity.com/astro/bluemoon.html](http://www.obliquity.com/astro/bluemoon.html)

**Leonid meteor shower:** [comets.amsmeteors.org/meteors/showers/leonids.html](http://comets.amsmeteors.org/meteors/showers/leonids.html)

**Geminid meteor shower:** [comets.amsmeteors.org/meteors/showers/geminids.html](http://comets.amsmeteors.org/meteors/showers/geminids.html)

**Map of lunar eclipse path:** [sunearth.gsfc.nasa.gov/eclipse/LEplot/LEplot2001/LE2001Dec30N.gif](http://sunearth.gsfc.nasa.gov/eclipse/LEplot/LEplot2001/LE2001Dec30N.gif)

**December solstice:** [www.treasure-troves.com/astro/WinterSolstice.html](http://www.treasure-troves.com/astro/WinterSolstice.html)