

Eclipses



There are two types of eclipses involving the Sun and the Moon. In a solar eclipse, part or all of the Sun is blocked by the Moon passing in front of it. In a lunar eclipse, the Moon passes through Earth's shadow in space, and part or all of it is cut off from direct sunlight. Eclipses are fascinating, but it is important to remember that direct viewing of any part of the Sun's disc – eclipse or no eclipse – is very dangerous.

Eclipses do not happen every month, because the Moon usually passes 'above' or 'below' the line joining the Sun and Earth. (The Moon's orbit around Earth is tilted about 5.1° to the plane of Earth's orbit around the Sun.) Also, an observer must be in the right place to see an eclipse: the Moon must be above the horizon for a lunar eclipse to be seen, and to witness a solar eclipse, the observer must be in the Moon's shadow.



Total solar eclipse, 2012 (M. George)



The Moon partially eclipsed (M. George)

Solar eclipses

A solar eclipse can occur only at the lunar phase called new moon, when the Moon is most directly in line with the Sun. (This is typically one or two days before we see the lunar crescent in the evening sky.) Solar eclipses are seen from only the parts of Earth over which the Moon's shadow falls.

The Moon's diameter is about 400 times less than that of the Sun, but the two appear to be about the same size because the Moon is about 400 times closer to us. This means that under ideal circumstances, the Moon can completely cover the Sun, but only briefly.

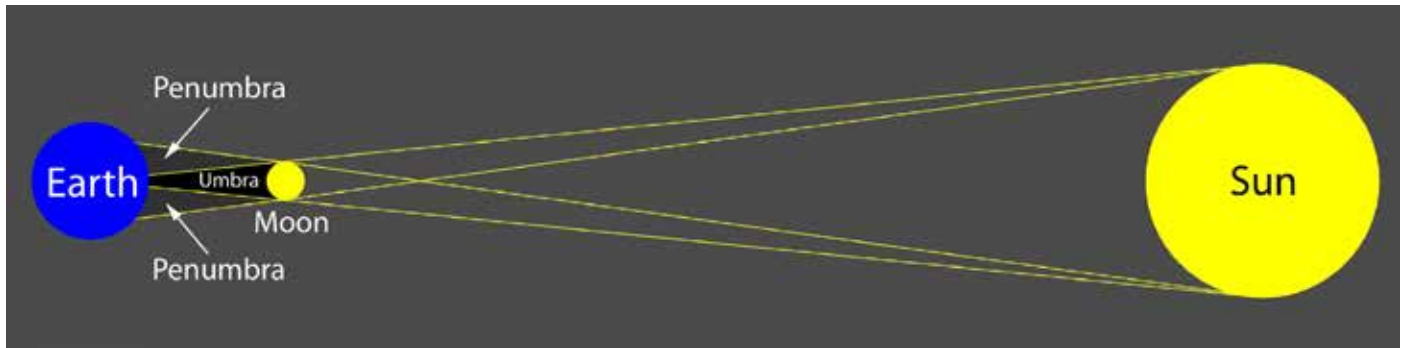
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From a relatively narrow path across Earth's surface, some solar eclipses are central, meaning that the Moon and Sun are seen in exactly the same direction, with the Sun being completely hidden (a total solar eclipse) or the Moon's silhouette appearing completely within the Sun's

disc (an annular solar eclipse, leaving a 'ring' of Sun). Whether a central solar eclipse is total depends on the relative distances between the Sun, Moon and Earth at the moment of the eclipse, because the orbits are not circular.



A total solar eclipse is caused by the umbra of the Moon's shadow falling on Earth. Elsewhere, in the penumbra of the shadow, only part of the Sun is covered. If the 'cone' formed by the umbra does not reach Earth, an annular eclipse will take place. Sizes and distances are not to scale.

Total solar eclipses are spectacular, but most people need to travel to ensure that they are within the path at the right moment. For any particular location on Earth, a total solar eclipse happens, on average, only about once every 400 years! The next one visible from anywhere in Tasmania will take place in June 2131. Partial solar eclipses, which are seen from a far wider area, are much more common, being seen every few years.

Sometimes, a solar eclipse is not central from anywhere on Earth. Under those circumstances, regions in the far northern or southern hemisphere will experience only a partial eclipse, and lower latitudes will see no event at all.

Solar eclipses can last for up to about two and a half hours. The total part can last for at most seven and a half minutes, but it is usually much shorter. The total part of the solar eclipse seen from Ceduna, South Australia, in December 2002 lasted for just 36 seconds!



A total solar eclipse, 2006 (M. George)



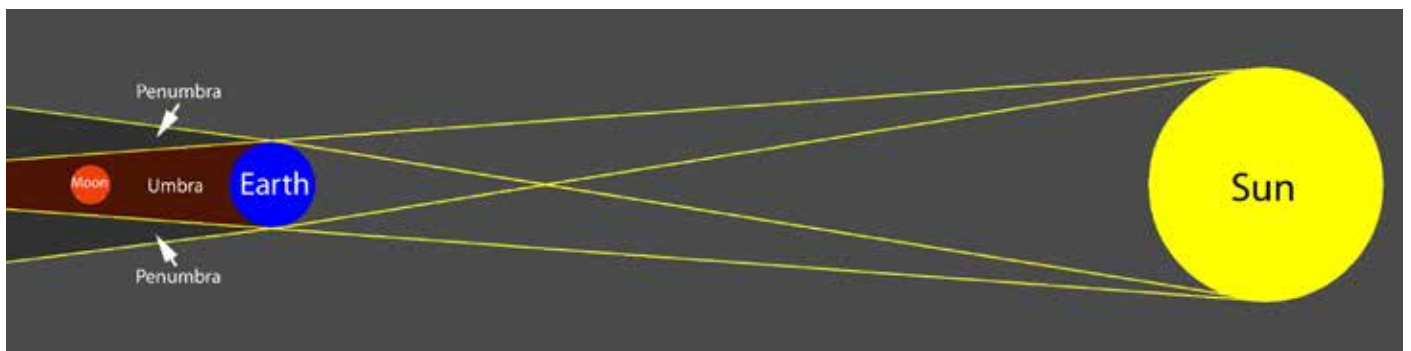
A partial solar eclipse, 1984 (M. George)

The change in light level on the ground is not easily noticeable until the Sun is about 80% covered. *During totality*, the ground illumination is rather like that of bright twilight. There is enough light to see to walk around, but some of the brighter stars and planets can typically be seen in the sky. It may be difficult to read settings on cameras, so it is important to ensure that a camera is set correctly well in advance. *During totality*, we can see the Sun's outer atmosphere

called the corona, because the direct light of the Sun is blocked. It is important to note that viewing any part of the Sun directly at any time – eclipse or no eclipse – is very dangerous, because the Sun's light and heat can cause permanent eye damage. This includes all times at which a solar eclipse is only partial or annular. Viewing a solar eclipse during totality is quite safe, but it is important to know exactly when this brief period will begin and end from one's location.

Lunar eclipses

A lunar eclipse can take place only at the phase called full moon, when it is in the opposite direction to the Sun. It is called a total lunar eclipse if the Moon becomes completely immersed in the umbra (the main, dark part) of Earth's shadow; if not, it is only a partial eclipse. During a total lunar eclipse, the Moon does not disappear completely, because some sunlight is bent in Earth's atmosphere and falls onto the Moon. The Moon then appears coppery-red, because more red light than blue passes through our atmosphere. It is always safe and fun to look at a lunar eclipse, and an even better view can be obtained using binoculars.



A lunar eclipse happens when the Moon enters Earth's shadow. When in the umbra (main part) of the shadow, it is cut off from direct sunlight. However, the shadowed part of the Moon is still faintly visible, because some light is bent in Earth's atmosphere and falls onto the Moon. It has a reddish colour because more red light than blue passes through the atmosphere.



A total lunar eclipse, 2014 (M. George)



A partial lunar eclipse, 1976 (M. George)

Another type of lunar eclipse is a penumbral lunar eclipse. This is when the Moon enters only the penumbra – the light, outer part – of Earth’s shadow. However, unless the Moon passes quite deeply into the penumbra, these events often pass unnoticed because some direct sunlight is

still falling onto the Moon. A lunar eclipse can last for up to about four hours (including the partial phases), and can be seen from anywhere on the Earth that has a direct view of the Moon. The total part of a lunar eclipse can last up to about 106 minutes, in extreme cases.

Solar eclipses that will be visible from Tasmania, 2023–2030

All times are in standard (not summer) time: GMT + 10 hours

20 Apr 2023 Partial (from Tasmania) solar

Visible in early afternoon. Total at Exmouth in Western Australia. From NW Tasmania, Maximum about 14:06 with 15% of Sun’s diameter covered.

22 Jul 2028 Partial (from Tasmania) solar

Visible during the afternoon. Total from NW Australia to Sydney. From NW Tasmania, maximum about 13:56 with about 80% of Sun’s diameter covered.

25 Nov 2030 Partial (from Tasmania) solar

Visible in late afternoon–early evening. Total from parts of South Australia, NSW and Queensland. From NW Tasmania, maximum at about 18:11 standard time with about 70% of Sun’s diameter covered.

Lunar eclipses that will be visible from Tasmania, 2023–2030

All times are in standard (not summer) time: GMT + 10 hours. Penumbral eclipses are not included.

14 Mar 2025 Partial (from Tasmania) lunar

Very last part of partial phase of a total lunar eclipse visible just after moonrise; totality not visible from Tasmania. Umbral part ends at 1848 standard time.

8 Sep 2025 Total lunar

Visible in entirety from Tasmania. Total from 03:31 to 04:53. Umbral phase begins at 02:27 and ends at 05:57 in twilight, but none of totality in twilight.

3 March 2026 Total lunar

Visible in entirety from Tasmania. Total from 21:04 to 22:03 standard time. Umbral duration 19:50 to 23:18.

7 Jul 2028 Partial lunar

Visible in entirety from Tasmania. Umbral duration 03:09 to 05:31. Maximum at 04:20 with 40% of Moon’s diameter in the umbra.

1 Jan 2029 Total lunar

Total from 02:16 to 03:28 Standard time. Umbral phase begins at 01:07 and ends at 04:37 Standard time, just before sunrise. Totality ends at beginning of nautical twilight.

16 June 2030 Partial lunar

Visible in entirety from Tasmania. Duration from 03:21 to 05:46. Maximum at 04:33 with 51% of Moon’s diameter in the umbra.

Dr Martin George
2023 February

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