

Great American Eclipse of 2017

A rare and special event, a total solar eclipse, will occur on Monday, August 21st, 2017. This will be the first total solar eclipse visible in the continental United States since 1979, a wait of 38 years! The path of totality, the area where people will be able to see the entire Sun blocked, will be 67 miles wide and will pass through 12 states from Oregon to South Carolina and over the homes of 12 million people; 200 million people live within a one day drive of the path of totality. Depending where you are in the path, totality will last between two and three minutes. If you are not in the path of totality, you will see a partial eclipse where the Moon will block part of the Sun, making the Sun look like it has had a bite taken out of it. Where you are in the country will determine how much of the Sun is blocked; in Northern Colorado approximately 95% of the Sun will be blocked. The partial eclipse in Colorado will start at 10:23 am and last until 1:14 pm; the peak will be at 11:47 am.

Fig. 1 Map showing the path of totality of the August 2017 eclipse. The blue lines mark the edges of the path of totality while the red line marks the center.

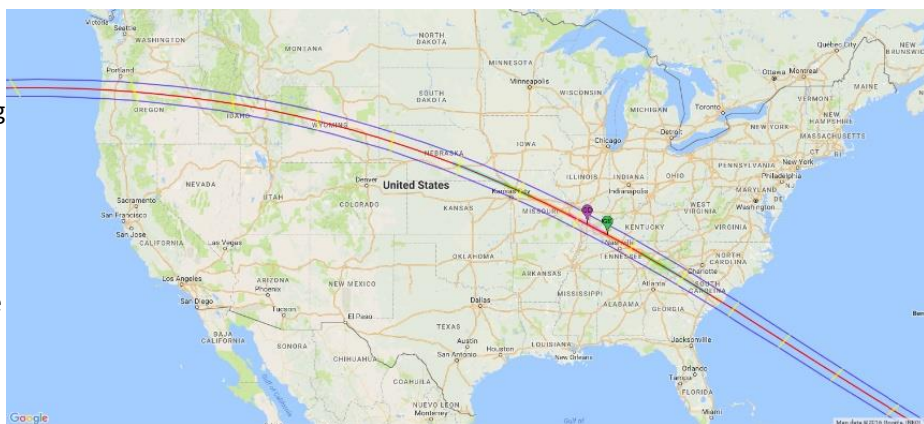
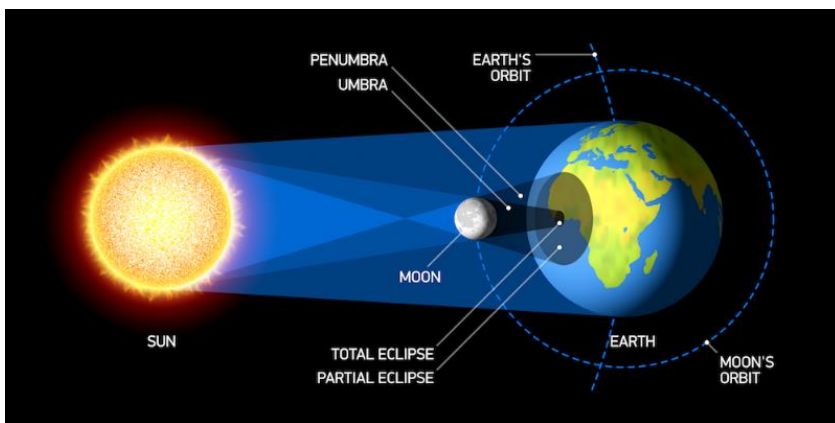


Fig. 2. Anatomy of a solar eclipse.



What is a Solar Eclipse

A solar eclipse occurs when the Moon lines up directly between the Earth and the Sun, casting a shadow on part of the Earth. The Moon's shadow has two parts, the umbra where all of the light from the Sun is blocked and the penumbra where part of the light from the Sun is blocked. The part of the Earth that is in the umbra will experience a total solar eclipse while the part in the penumbra will experience a partial eclipse. Because the Moon doesn't orbit the Earth in a perfect circle, its distance from the Earth changes. If the Moon is too far away during an eclipse, its shadow will fall short of the Earth, resulting in an annular eclipse where the Moon isn't large enough to block out the entire Sun, leaving a ring, or annulus, of the Sun visible.



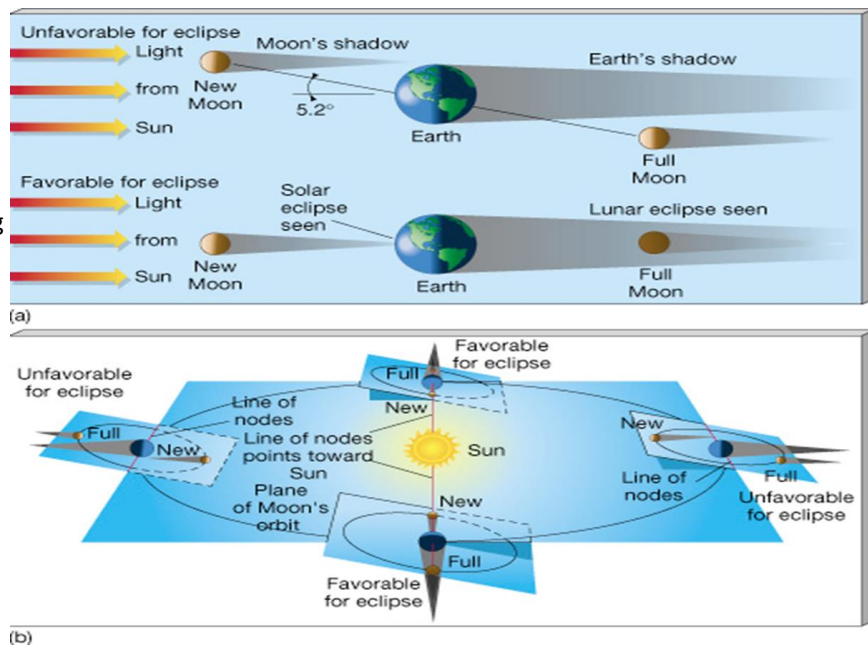
Fig. 3 During a total solar eclipse, the entire Sun will be blocked by the Moon (top left picture). During a partial eclipse part of the Sun is blocked by the Moon, resulting in the Sun looking like a bite has been taken out of it (top right picture). During an annular eclipse, the Moon is too far from Earth and thus has an angular size too small to block out the entire Sun, leaving a ring, or annulus, of the Sun visible (bottom left picture).

Why Are Solar Eclipses So Rare?

Between 2001 and 2100, there will be 75 total solar eclipses, 77 partial solar eclipses, and 72 annular solar eclipses. If solar eclipses occur because the Moon gets between the Earth and the Sun, why do we not see one each month?

The answer lies in the orientation of the Moon's orbit around the Earth and the Earth's orbit around the Sun. The Moon's orbit around the Earth is inclined by about 5.2° to the Earth's orbit around the Sun. This means that most of the time when there is a New Moon, the phase the Moon must be in to possibly have a solar eclipse, its shadow falls above or below the Earth and thus it does not block out the Sun. There are only two possible times a year when the Moon could be in the New phase and be in the plane of the Earth-Sun orbit, however the Moon isn't always in the right spot at these times. If the Moon is very close to one of these two spots but not perfectly in it, we will only get a partial eclipse.

Fig. 4 Diagram showing the Moon's orbit around the Earth and the Earth's orbit around the Sun. Because the orbits are tilted relative to each other, the Moon's shadow will normally fall above or below the Earth when it is a New Moon resulting in no solar eclipse occurring.



Observing A Solar Eclipse

Given the rare nature of solar eclipses, you should not miss out on a chance to see this one; there will not be another total solar eclipse visible in the continental US until 2024 and we will not see another solar eclipse this good in Colorado until 2045. While observing an eclipse is exciting, it is important to do so safely in order to avoid potential eye damage due to how bright the Sun is. UNC has published a separate flier talking about how to safely observe an eclipse.

Fig. 5 Maps showing the paths of all total and annular eclipses from 1961-2040.

