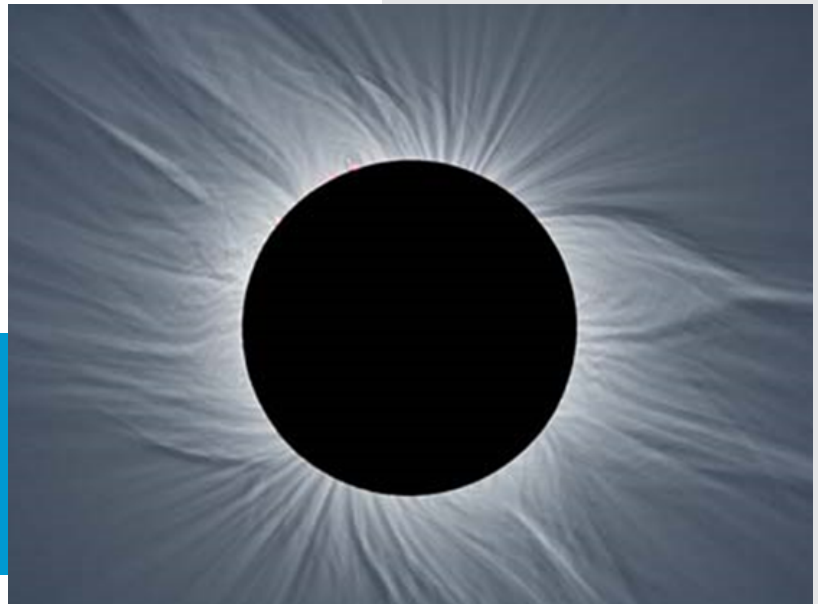


A Total Eclipse of the Sun



If you didn't see the total eclipse on August 21, 2017, you may be wondering, "How did I miss it? It was supposed to be a total eclipse."

Well, a total eclipse happens only when the moon passes perfectly in front of the sun, blocking its view from Earth. Because the moon is so much smaller than the sun, the "path of totality," where the sun is completely obscured, is quite narrow.

This may be easiest to imagine if you picture the view from space. You'd see a small moon shadow 70 miles wide cast upon the surface of Earth and moving across it at 1,500 miles an hour.

That moon shadow crossed the U.S. from Oregon to South Carolina, passing over 50 million people who live there—and several million more who traveled there to see it. And I was one of them.

Here's what we saw:

The moon shadow raced forward, eventually engulfing us. Darkness fell. The temperature dropped 10 degrees. Sunset descended on all horizons. Birds stopped chirping, and night insects began.

It was an amazing, almost unnerving experience.

Then as quickly as it started, it was over, and the moon shadow raced on.

Now, if I'm making you more disappointed that you missed it, don't be. Seven years from now, a total eclipse will return. Because of the orientation of the sun, moon, and Earth, the path of totality will be wider, and it will cross from Texas to Maine.

So set a reminder on your calendar for April 8, 2024.

2006 eclipse over Libyan Desert. Composite image reveals subtle structure in sun's corona.

Credit: Frank Espenak

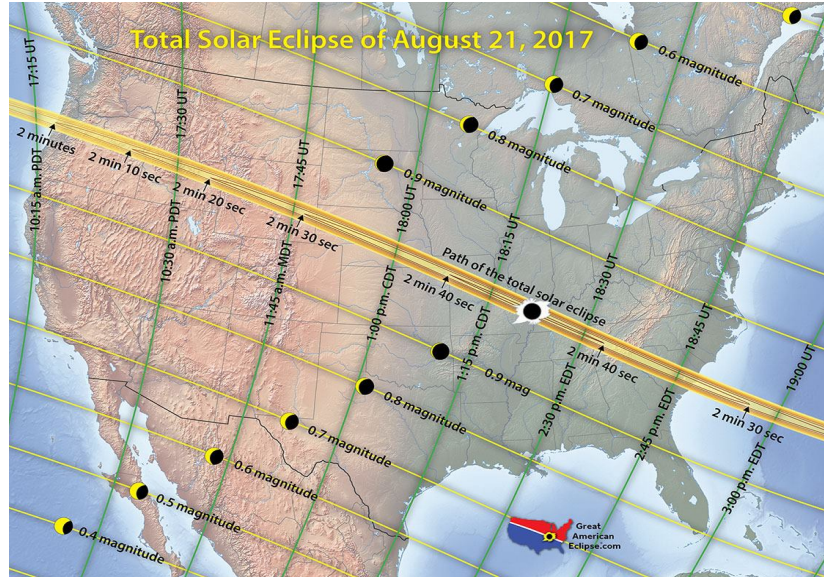


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A Total Eclipse of the Sun BACKGROUND

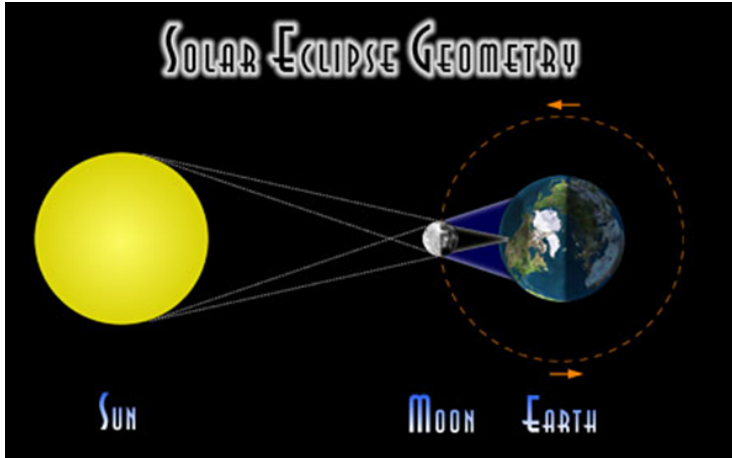
Synopsis: On August 21, 2017, the United States was treated to an extraordinary natural event: a total eclipse of the sun that streaked from Oregon to South Carolina at supersonic speed, around 1,500 mph—almost Mach 1.5! It had been 38 years since the last total eclipse viewable from the United States.

- Eclipses are simply the shadow that one celestial body casts on another, as viewed from Earth. For a shadow to be cast, the light source (sun) and the two bodies (Earth and moon) must line up; however, the moon's orbit is tilted about 5 degrees from Earth's, so conditions favorable for eclipses only happen when the geometries of the elliptical orbits align.
- You may have seen **lunar eclipses**, which are visible from an entire hemisphere as the full moon traverses the large shadow cast by Earth for a couple of hours.
- **Solar eclipses** occur when the new moon casts a shadow on Earth. If you are outside of the central umbra shadow, you may see a partial eclipse that will look like a bite being taken out of the sun; the sun will still be almost as bright as usual, so be sure to use eye protection!



On map above, yellow curves parallel to path of total solar eclipse mark the degree of maximum partial eclipse. Green lines show times of greatest eclipse as they sweep across the country. Orange curves inside path of total solar eclipse show its duration. More than 50 million people live in the path of totality.

Credit: Michael Zeller, Great American Eclipse.com



Geometry of the sun, Earth, and moon during an eclipse of the sun. The moon's two shadows are the penumbra and the umbra. (Sizes and distances not to scale.)

Credit: Fred Espenak, MrEclipse.com

- **Total solar eclipses** are very special because they completely block the brightness of the sun, revealing the aura of its corona.
 - Total solar eclipses are more difficult to view because the moon casts a relatively small shadow on Earth—over only about 1% of the diameter—ranging from 50 to 125 miles wide, depending on how close the moon is to Earth. You must be in this umbra shadow to see the corona.

A Total Eclipse of the Sun References

- Eclipse 2017 | NASA
- The "Great American Total Solar Eclipse" of 2017 (with video) | Space.com
- 25 Facts About 2017 Total Solar Eclipse | Astronomy Magazine
- Solar Eclipses for Beginners | MrEclipse.com
- 2017 US Eclipse Map | Eclipse2017.org

Contributors: Juli Hennings, Harry Lynch



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A Total Eclipse of the Sun

BACKGROUND

- In 2017, although all of North America will be in the penumbra, the umbra will be a laser-thin 40–70 miles wide, sweeping across Oregon, Idaho, Wyoming, Kansas, Missouri, Illinois, Kentucky, Tennessee, Georgia, and finally South Carolina during its 90-minute traverse of the continent. The maximum length of totality, 2 minutes and 40 seconds, will occur in the center of the path in Illinois.
- At this special time in Earth’s history, we enjoy a cosmic coincidence that makes total solar eclipses possible: the sun and moon seem to be about the same size in our sky. The sun has a diameter about 400 times larger than that of the moon, and the moon is about 400 times closer to Earth than the sun, enabling the moon to almost exactly cover the bright disc of the sun to reveal the corona.
- What is the experience of a total eclipse?
 - The western sky will darken for more than an hour as the huge shadow approaches; be patient, and always use eye protection to look at the partially eclipsed sun!
 - If you are on high ground, you may see the shadow rush up to you and engulf you; around the horizon, it will look like a 360-degree sunset/sunrise.
 - Around the disc of the sun, the corona exhibits flares and mass ejections, as well as multispectral effects.
 - Shadows will look different, breezes will calm, temperatures will drop 10–15°F, birds will return to their nests and stop singing, and crickets and frogs will begin their evening songs.



Earth as seen from the *Mir* space station during a solar eclipse in 1999.

Credit: Mir 27 Crew; copyright: CNES

- In minutes the whole phenomenon reverses: the shadow rushes away from you and the birds sing again.
- If you missed this one, you will get another chance in 2024. Another total eclipse will occur in the early afternoon of April 8, 2024, ranging from Texas to Maine. The umbra will be about twice as wide as in 2017, so viewing will last about twice as long. The 2017 and 2024 paths cross in Carbondale, Illinois.

A Total Eclipse of the Sun References

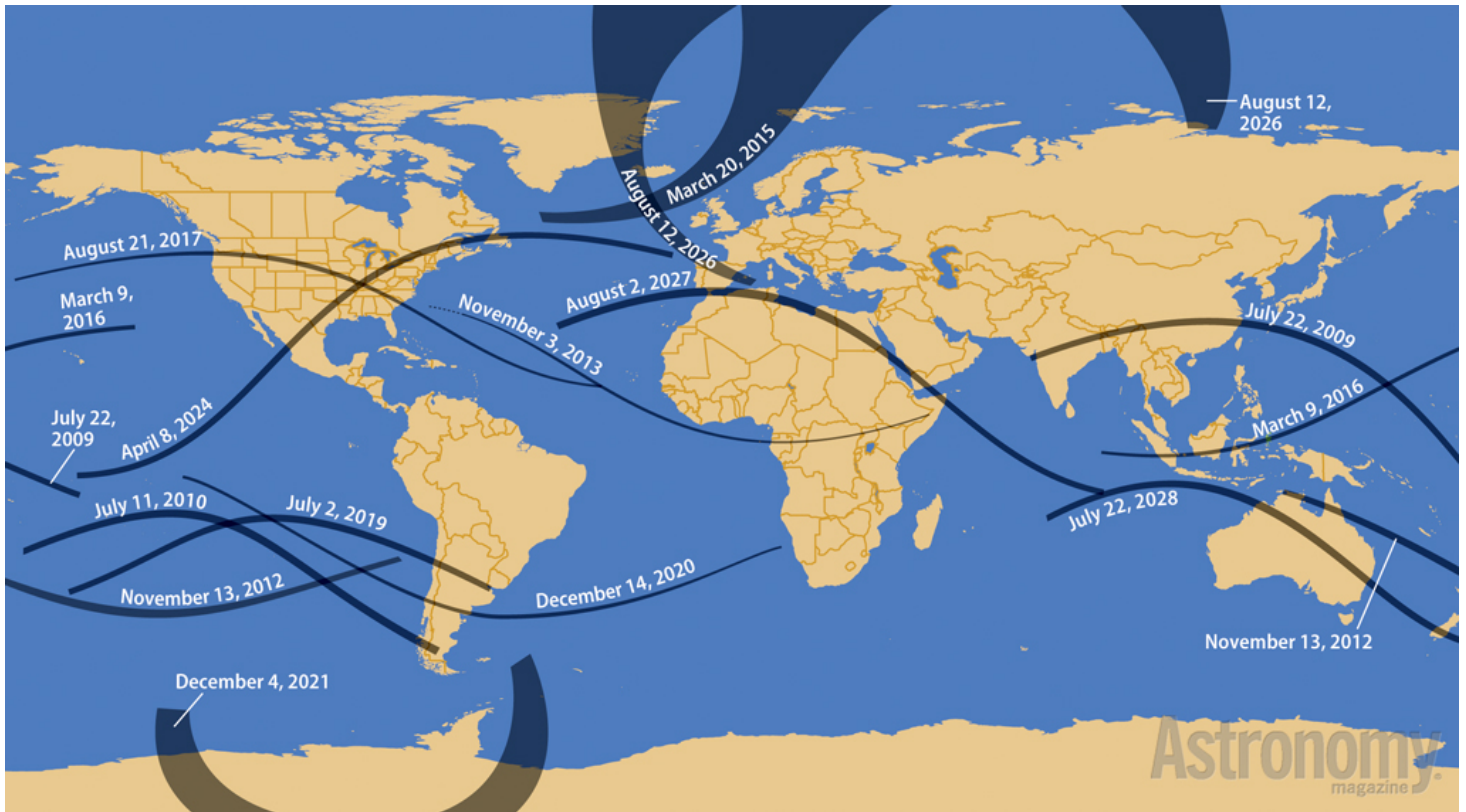
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A Total Eclipse of the Sun BACKGROUND



Paths of 15 future total eclipses through 2028.

Credit: Astronomy: Roen Kelly after Fred Espenak, NASA/Goddard Space Flight Center

To find out what you will be able to see of future eclipses from your location:

[Find Solar & Lunar Eclipses in Your City | Timeanddate.com](http://Timeanddate.com)

A Total Eclipse of the Sun References

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