

# Countdown begins for the great North American solar eclipse

April 4 2023

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Annular (left) and total solar eclipses at the same scale. Credit: Annular eclipse: Richard Tresch Fienberg; *Sky & Telescope* and the American Astronomical Society; Solar eclipse: Richard Tresch Fienberg, processing by Sean Walker; *TravelQuest International* and *Sky & Telescope*

One year from now, on Monday, 8 April 2024, the moon will pass directly between Earth and the sun, creating a total solar eclipse like the one that crossed the United States from coast to coast on 21 August 2017. As it did that day, the new moon will fully block the sun's bright face, turning day into night for several minutes and revealing the magnificent solar corona, our star's wispy outer atmosphere. Our natural satellite's dark shadow, about 115 miles wide, will cross Mexico, sweep from Texas to Maine, and then darken the Canadian Maritimes. Outside

this narrow path, nearly everyone in North America will get a chance to witness a partial solar eclipse.

Remarkably, we'll have had another major [solar eclipse](#) just six months earlier. But on Saturday, 14 October 2023, when the moon is centered in front of the sun, it will cover only 90% of the brilliant solar disk. The remaining 10% will appear as a blazing "ring of fire" around the moon's black silhouette. This annular (Latin for ring-shaped) solar eclipse will be visible within a roughly 125-mile-wide path from Oregon to Texas and on into Mexico, Central America, and northern South America. Again, most North Americans outside the path will experience a partial solar eclipse.

## Where and how to see them

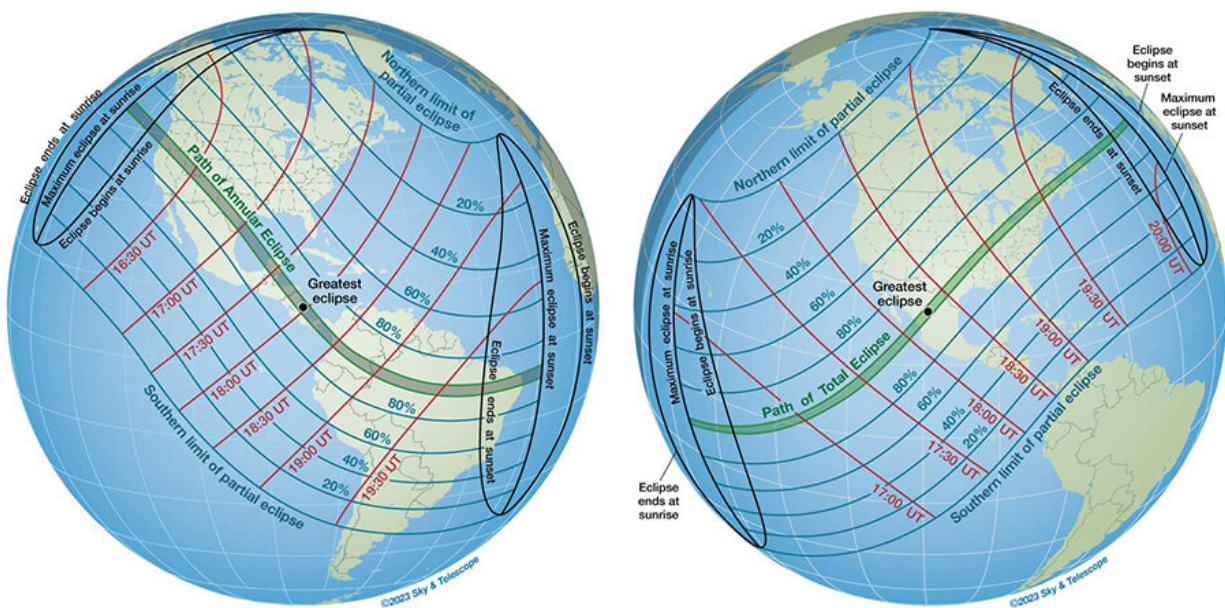
From beginning to end, a solar eclipse lasts up to about 3 hours. For most of that time, the moon slowly covers the sun, then uncovers it; these are the eclipse's beginning and ending partial phases. The real excitement comes in the middle, but only for those within the narrow path of the moon's dark shadow, and only for a few fleeting minutes.

8 April 2024: The moon's shadow will pass over more big cities than in 2017 and give at least 30 million Americans a shot at seeing the solar [corona](#) without having to travel. But there's a catch: In early April much of the country is still in winter's grip. Clear skies are most likely across Mexico and Texas Hill Country, and these places also happen to be where totality—the brief total phase of the eclipse—lasts longest, nearly 4½ minutes. Many diehard eclipse enthusiasts have already made plans to visit Mexico or Texas next April.

14 October 2023: Weather prospects for the annular eclipse look most promising in parts of Utah, New Mexico, and Texas, where the "ring of fire" lasts about 5 minutes.

During partial and annular solar eclipses, the sun remains dangerously bright at all times and must never be looked at directly except through special-purpose "eclipse glasses" or handheld viewers that meet the requirements of the ISO 12312-2 international standard. [Get advice](#) on where to get safe solar filters and on indirect viewing methods. During totality you can safely [view](#) the eclipsed sun without eye protection.

"If you can get yourself into the path of the moon's shadow for a total solar eclipse, it's definitely worth the effort," says Rick Fienberg, Project Manager of the American Astronomical Society (AAS) Solar Eclipse Task Force and Senior Contributing Editor of *Sky & Telescope*. "A 99% partial solar eclipse doesn't get you 99% of the experience of a total solar eclipse—the last 1% is literally the difference between night and day. As the moon blots out the thinning arc of the bright sun in the final minute before totality, daylight fades by up to 1,000 times. And the solar corona surrounding the moon's velvety black silhouette is one of the most glorious sights in all of nature."



Maps showing the paths of the October 2023 annular (left) and April 2024 total solar eclipses. The 14 October 2023 annular solar eclipse can be witnessed in the United States along a narrow strip from Oregon through Texas. After that, the moon's shadow crosses the Yucatán Peninsula, Central America, Colombia, and Brazil. Annularity lasts longest, about  $5\frac{1}{4}$  minutes, just off the coast of the Nicaragua–Costa Rica border. Blue percentage lines refer to eclipse magnitude, the fraction of the Sun's diameter covered by the moon at maximum eclipse. Within the green path, that fraction is about 95%. Red lines indicate when maximum eclipse occurs in Universal Time, which is 4 hours ahead of Eastern Daylight Time (7 hours ahead of Pacific Daylight Time) in the United States. Over the 8 April 2024 eclipse's total duration of 3 hours 15 minutes, the moon's shadow travels along a 9,200-mile strip that extends from the Pacific Ocean, across North America, to the Atlantic Ocean. At the point of greatest eclipse totality lasts nearly  $4\frac{1}{2}$  minutes. Blue percentage lines refer to eclipse magnitude, the fraction of the sun's diameter covered by the moon at maximum eclipse. Within the green path, that fraction exceeds 100%. Red lines indicate when maximum eclipse occurs in Universal Time, which is 4 hours ahead of Eastern Daylight Time (7 hours ahead of Pacific Daylight Time) in the United States. Credit: *Sky & Telescope* / Fred Espenak

During a total solar eclipse you'll experience many other noteworthy phenomena, including a drop in air temperature, changes in wind speed and direction, bright planets and stars shining in deep twilight, ruby-red solar prominences (eruptions of hot gas protruding beyond the limb, or edge, of the sun's hidden disk), pastel sunrise/sunset colors around the horizon, and plants and animals behaving as if the sun has set. Another total solar eclipse won't cross the U.S. until 12 August 2045, so the April 2024 event is your best chance to catch totality for a generation.

## Getting organized

The AAS Solar Eclipse Task Force, partnering with the outreach team for NASA's PUNCH (Polarimeter to UNify the Corona and

Heliosphere) mission, is holding a hybrid (in-person + virtual) [planning workshop](#) Friday–Saturday, 9–10 June 2023, at the New Mexico Museum of Natural History & Science, 1801 Mountain Rd. NW, Albuquerque, NM 87104, on the heels of the [AAS summer meeting](#) in the same city.

This workshop is for everyone involved (or wanting to become involved) in preparing their community for the upcoming North American solar eclipses, whether on or off the eclipse path(s). Attendees will include amateur and professional astronomers; formal and informal educators; local, state, and national government officials; representatives from the tourism and hospitality industries; professionals in health, safety, transportation, and emergency management; local, state, and national park rangers; and artists, filmmakers, science writers, and event planners.

Links to essential eclipse resources for a wide variety of stakeholders can be found on the task force's websites at [eclipse.aas.org](http://eclipse.aas.org) and [eclipse2024resources.com](http://eclipse2024resources.com).

## **Eclipse geometry**

We get solar eclipses because by an amazing cosmic coincidence, the sun and moon appear almost exactly the same size in our sky. The sun's diameter is really about 400 times bigger than the moon's, but the sun is also about 400 times farther away. Because Earth's orbit around the sun and the moon's orbit around Earth are both ellipses rather than circles, the apparent sizes of the sun and moon vary a little during the year (sun) and during each month (moon).

Our planet is closest to the sun ([perihelion](#)) in early January and farthest (aphelion) in early July, and the sun appears about 3% wider in January than in July—not that you'd notice. When the moon is closest to Earth

(perigee), its apparent diameter can be up to 14% larger than when it's farthest (apogee); again, this effect is not too noticeable. When the moon is closer than average and the sun farther away than average, as will be the case on 8 April 2024, the moon can easily cover the entire solar disk and unveil the ethereal corona. But when the opposite is true, as will happen on 14 October 2023, the moon is too small to fully cover the sun's face, so at mid-eclipse, a brilliant annulus (ring) of sunlight encircles the lunar silhouette.

You might wonder why we don't have a solar eclipse at every new moon. This is because the moon's orbit around Earth is tipped by about  $5^\circ$  to Earth's orbit around the sun (which, from our perspective, is the sun's annual path through the zodiacal constellations). At new moon, our natural satellite usually passes above or below the sun. But twice each year, currently in April and October, the new moon does pass in front of the sun, so we get solar eclipses—including one in Australia and Indonesia on April 20 this year. Whether a solar eclipse is partial, annular, or total depends on how precisely the sun, moon, and Earth align and on the distances of the [moon](#) and sun from Earth.

**More information:** For more information about the October 2023 annular eclipse, see "[Solar and Lunar Eclipses in 2023](#)" on Sky & Telescope's website. A thorough preview of the April 2024 total solar eclipse appears in the April 2023 issue of Sky & Telescope magazine, now on newsstands.

You can get local circumstances of upcoming solar (and lunar) eclipses for cities worldwide on [TimeandDate.com's Eclipses page](#).

Provided by American Astronomical Society

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