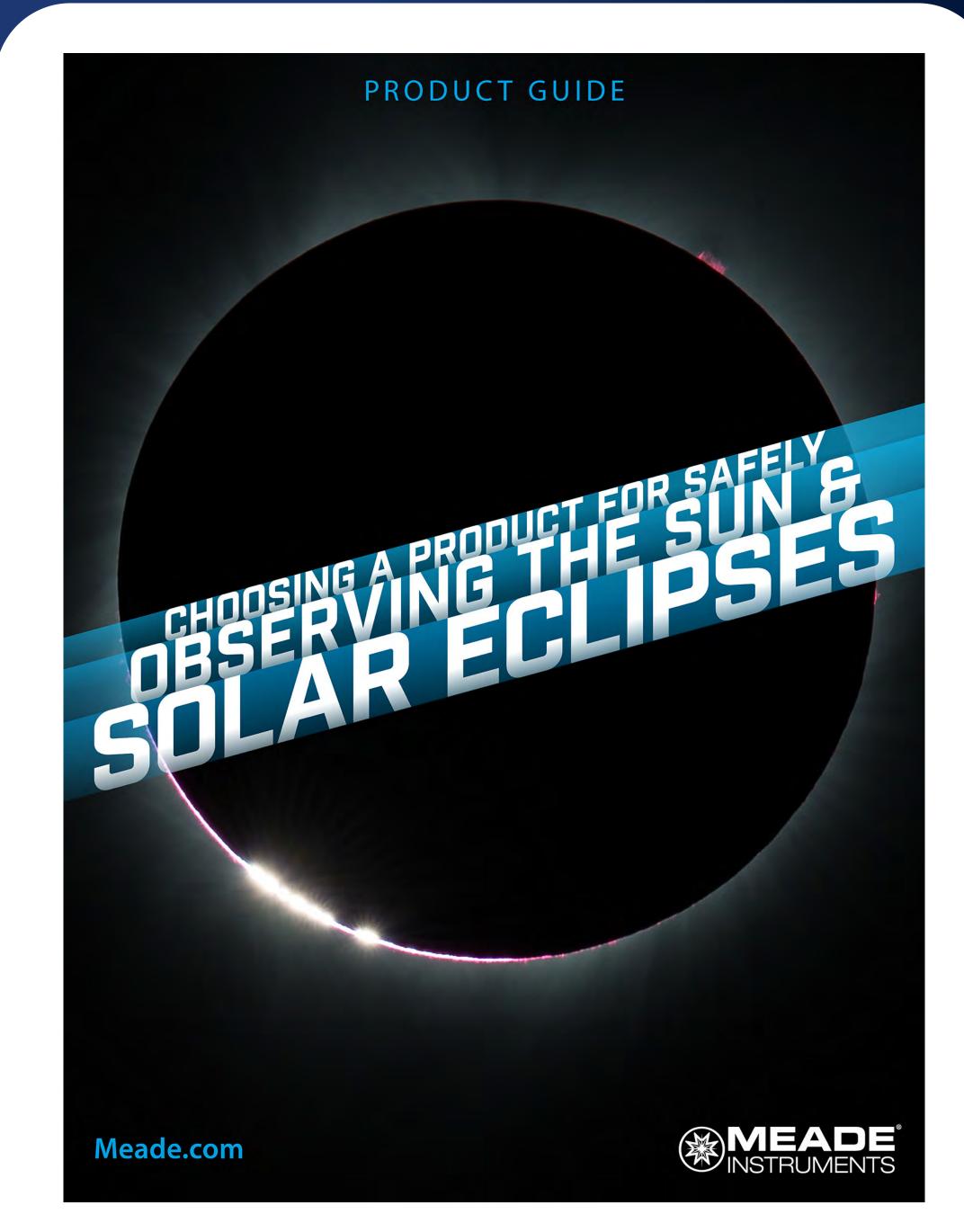


April 8, 2024 North American Total Solar Eclipse: Viewer's Guide Page T1



Choosing a Product for Safely Observing the Sun & Solar Eclipses Page PG1

Meade.com



VIEWER'S GUIDE



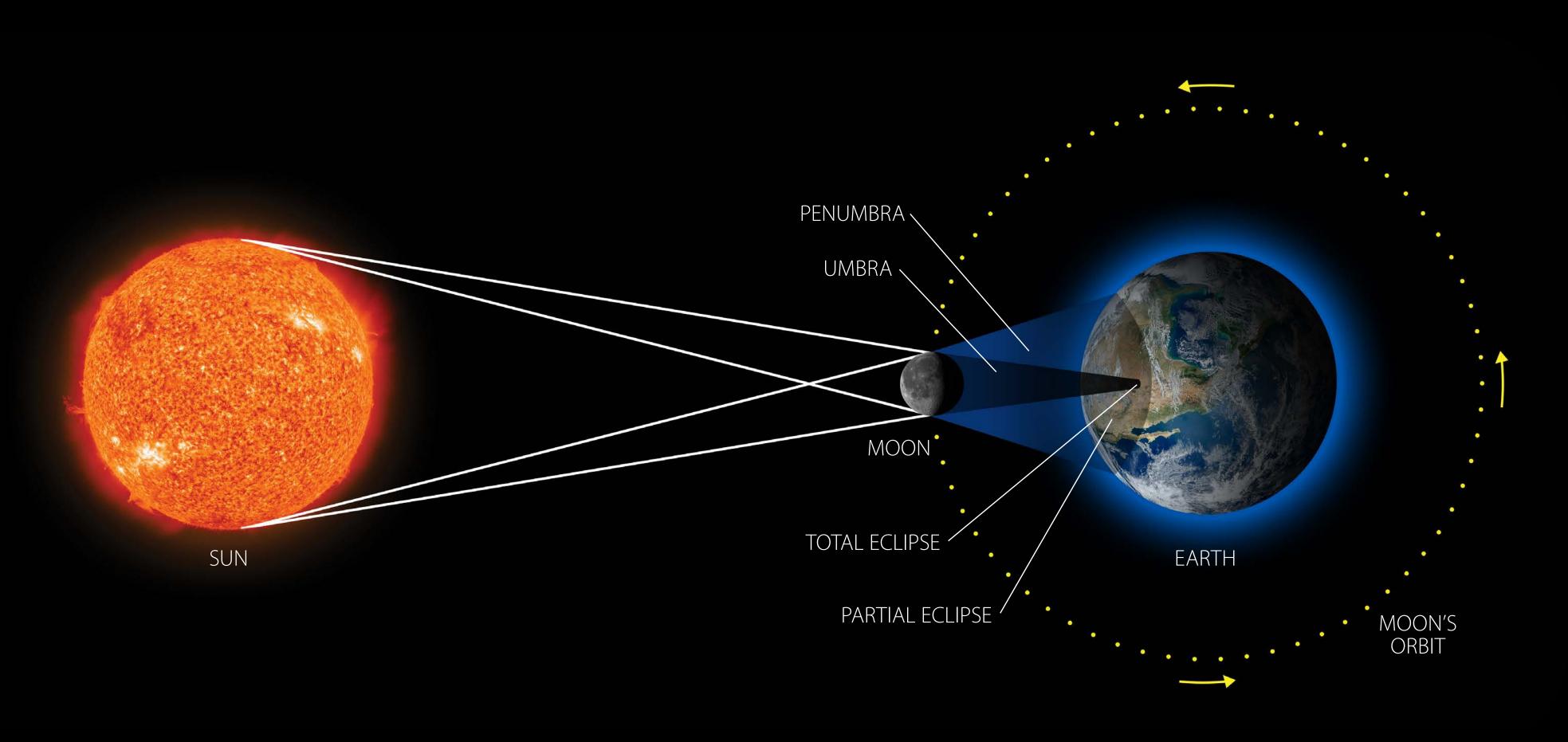


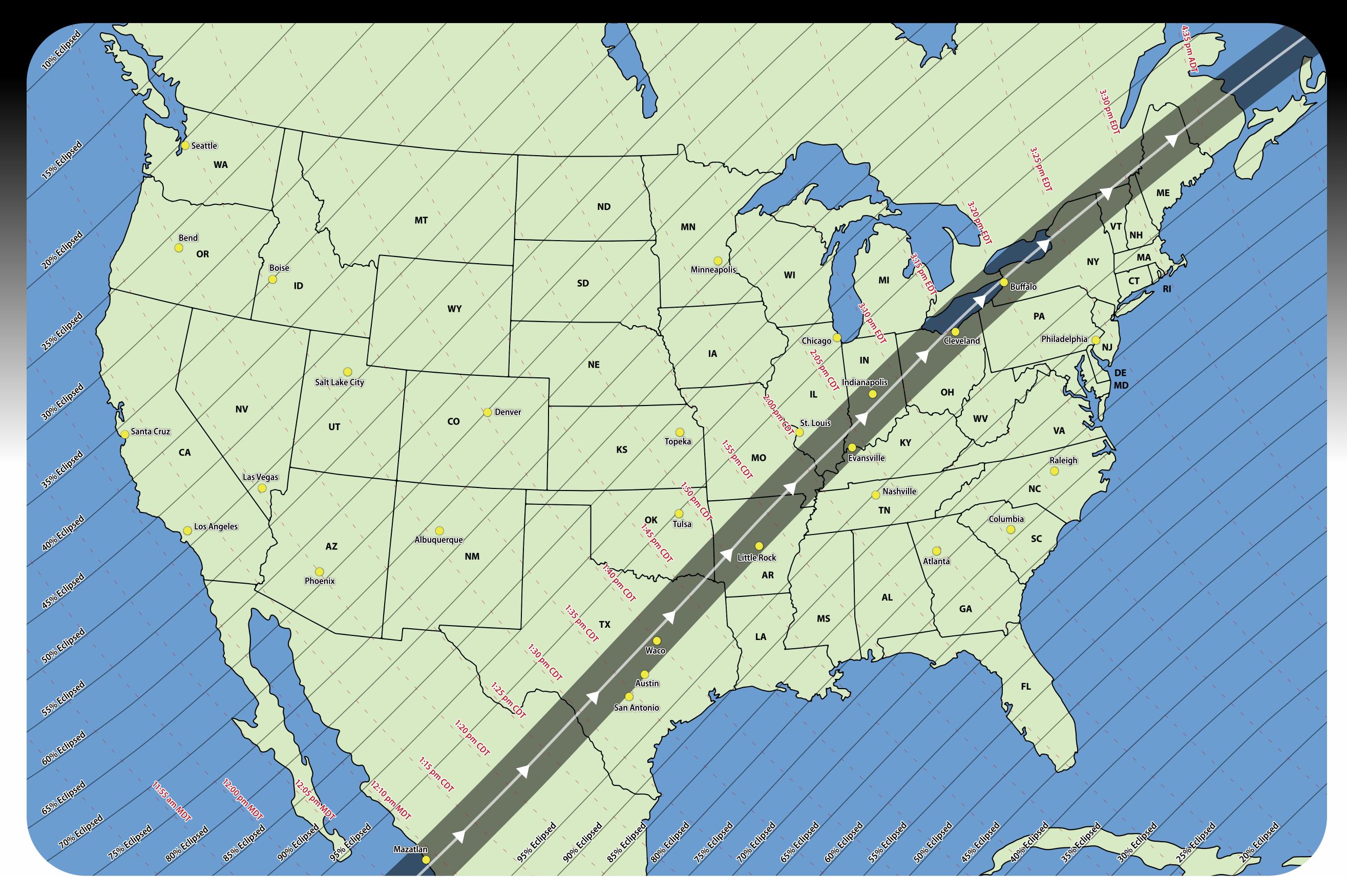


On April 8, 2024, a total eclipse of the Sun will occur over North America and cross a vast swath of the continental United States, giving millions of people a rare opportunity to see one of the most visually exotic events in nature. Coming so soon after the spectacular total solar eclipse of 2017, which wowed American viewers from coast to coast, the 2024 eclipse will feature a wider path and last twice as long!

What is a Total Solar Eclipse?

A total solar eclipse occurs when the Moon passes directly in front of the Sun, completely covering its luminous disk. The dark shadow (the umbra) cast onto the Earth by this blockage sweeps eastward in a narrow path—the "path of totality." Anyone inside the boundaries of this path under clear skies will see daylight turn to near darkness, and the Moon's silhouette ringed by a pearly white corona—the Sun's ethereal outer atmosphere.





The Path of Darkness

The April 8, 2024 path of totality cuts northeast across the United States from Texas to Maine, crossing parts of 11 other states (*see the map above*). If you are outside the path, you'll be enveloped in the Moon's pale outer shadow (the penumbra) and experience only a partial eclipse. The closer you are to the path, the more the Sun's disk will be eclipsed. But even a 99% partial eclipse will fall short of the wondrous spectacle of totality. The unblocked 1% of sunlight will overpower the corona, hiding it from view. So if at all possible, get yourself inside the path of totality—or you'll miss the jaw-dropping main event.

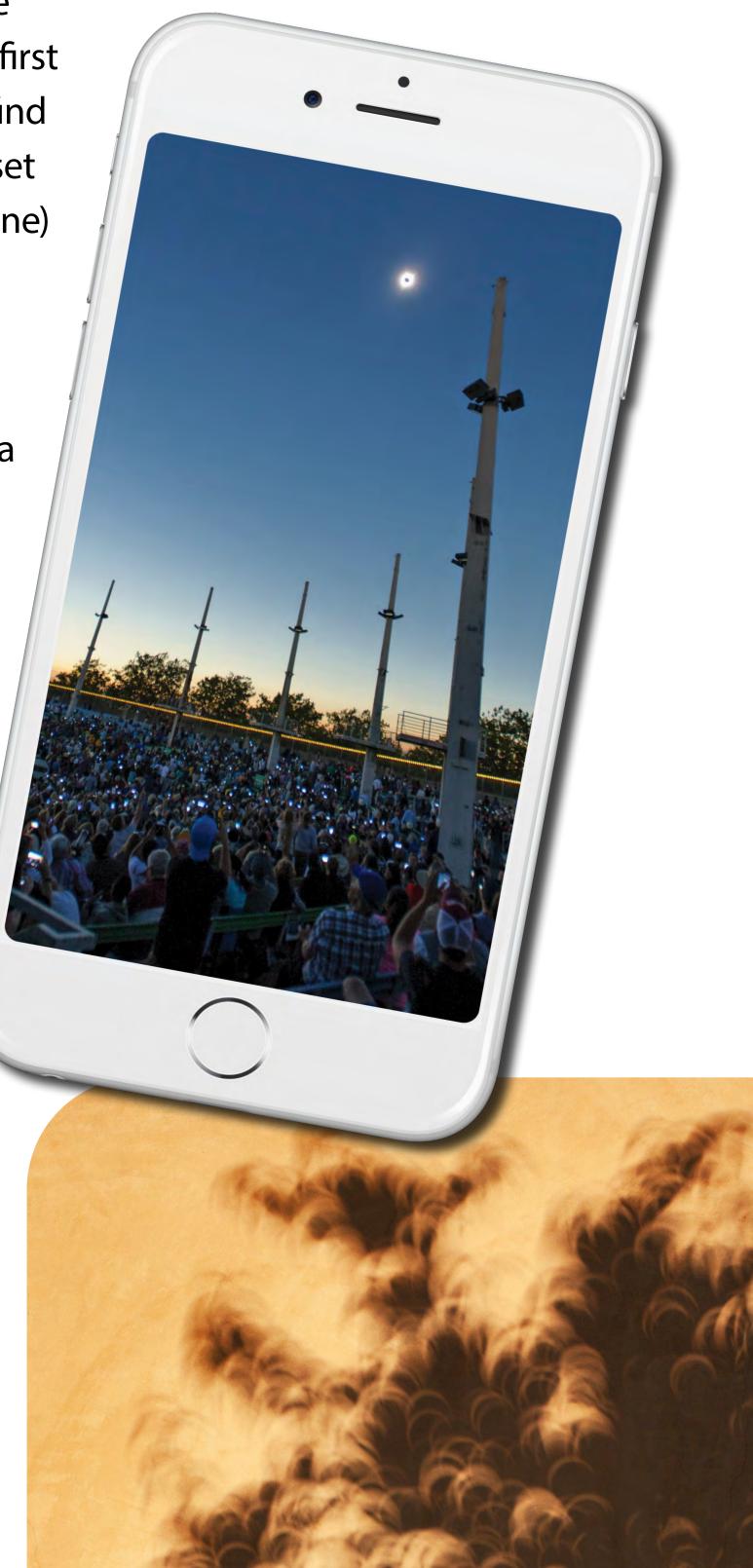
Time and Duration of Totality

The time of occurrence and duration of totality depend on your location in the path. As the shadow sweeps northeastward, the eclipse occurs slightly later in the day—with totality starting at 1:27 p.m. CDT in Texas and ending at 3:35 p.m. EDT in Maine. The maximum duration of totality also decreases a bit—from 4 minutes 25 seconds at the Texas-Mexico border, to around 3 minutes 22 seconds at the Maine-New Brunswick border. And the closer you are to the path's centerline—the imaginary line that runs midway between its outer boundaries—the longer totality will last. For example, while viewers near the centerline in Sulphur Springs, Texas will see 4 minutes 21 seconds of totality, those along the path's edge to the east or west of Sulphur Springs will see only ~45 seconds.

Prepping for the Big Event

The first order of business: make plans to get to the path of totality! Anywhere outside of it and you're going to see only a partial eclipse. And be forewarned, hotels, rentals, and campgrounds inside or near the path can book up many months in advance—so make your travel plans early!

- 1. Gather your gear—Give yourself plenty of time before the big day to get all the gear you'll need together. Lawn chairs, food and drink, sun hat, and sunscreen since you'll be outdoors on a (hopefully!) sunny day, for starters. Order some ISO-approved eclipse glasses. If you will be using a telescope, binoculars, and/or a camera, bring all the needed components, including a solar filter properly sized for your instrument. Purchase the eclipse glasses and solar filters well in advance while retailers' supplies are plentiful.
- 3. Arrive early—Get to your eclipse viewing site a few hours before first contact. This gives you time to find a good spot, unload your gear, set up your telescope (if you have one) and/or camera equipment, and bask in the excited vibe.
- 4. Have your phone ready—Use



2. Create an eclipse "workflow"—You may want to review or even rehearse the actions you plan to take during the eclipse, especially if you will be viewing and photographing it. The particular actions, their timing, and the order in which you do them constitute your eclipse workflow. Memorize it.



Experiencing a Total Solar Eclipse First Contact: The Bite

The eclipse kicks off at *First Contact*, the moment when the Moon's leading edge contacts the Sun's disk. This is the beginning of the partial phase. Look closely and you will see a small black "bite" out of the Sun's disk, on its western side. The "bite" slowly grows bigger as time progresses.

your smartphone's video camera or an audio recording app to make periodic notes as the eclipse progresses about things like the changing temperature, quality of ambient light, changes in the behavior of animals, and the reactions of other eclipse-watchers. It will be fun to compile and relive your observations later.

It's interesting to note that before first contact, you can't see the Moon approaching the Sun at all. That's because it is in the "New Moon" phase, when none of its Earth-facing side is illuminated. Only when it begins passing in front of the Sun can we see the Moon—in silhouette against the Sun's bright disk.

About 30 minutes into the eclipse, if you are near a tree, you may notice numerous "crescent Suns" on the ground below it. They're caused by sunlight passing through tiny gaps among the tree leaves. These gaps project and magnify the bright crescents onto the ground. Bring a piece of pegboard or a colander—anything with small holes in it—to produce the same effect yourself!

It's Getting Cooler, Darker

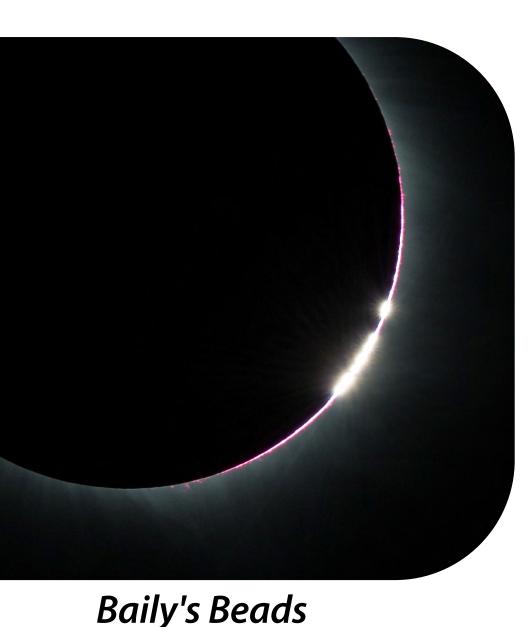
When about half of the Sun's disk is covered, see if you can feel the temperature cooling a bit. (Consider bringing a thermometer to make periodic temperature readings.) Has a breeze kicked up as well? The surroundings are looking a little darker, as with an approaching sunset.

When about 75% of the Sun's disk is eclipsed, sky color deepens and clouds become more pronounced. The eastern horizon exhibits richer yellow and orange hues, while the western horizon is growing darker, gloomier. Shadows take on a sharper and more contrasty appearance.

When the Sun shrinks to a thin crescent in the minute or two before totality, you will definitely notice the chill in the air. Pets might start acting nervously, sensing that something is up. Look down (remove your solar glasses for a moment) and see if you can detect shadow bands—alternating dark and light bands that wash across the ground like ripples in a pool. They occur when light from the Sun's narrowing crescent interacts with turbulent air in Earth's atmosphere. They're easiest to see on flat, white surfaces; some observers will spread out a white sheet to try to see them better. The sky around the Sun turns twilight purple. The western horizon grows darker and more ominous as the Moon's umbral shadow races toward you.

Projected "Crescent Suns"





Baily's Beads and the Diamond Ring

In the few seconds before totality, the remaining sliver of Sun transforms into a "string of pearls" called Baily's Beads, caused by the last shafts of sunlight shooting through deep valleys on the Moon's eastern edge. These beads are fleeting, though, quickly winking out until just one remains—creating a stunningly beautiful *Diamond Ring*! At this point everyone within earshot will be gasping with awe, whooping with excitement, yelling "Oh my god!", even applauding!

Second Contact: Totality Begins

When that last bead disappears, that's *Second Contact*, the start of totality.



Diamond Ring







IT IS NOW SAFE TO REMOVE YOUR ECLIPSE GLASSES AND ANY SOLAR FILTERS FROM YOUR BINOCULARS OR TELESCOPE.

The Sun's mesmerizing, ghostly white corona now streams outward in all directions from the Moon's dark disk. You may also make out a bright red fringe on the Moon's limb. This is the Sun's thin middle atmosphere, the chromosphere. With the aid of a telescope or binoculars you may spot magenta-red knots and streamers called "prominences" reaching up from the chromosphere. They are colossal eruptions of hydrogen gas being ejected in jets and curls from the Sun's surface. Their number, size, and shape vary from one eclipse to another.

Stars and a 360-Degree Sunset

With the Sun now gone, but for its ethereal corona, daylight has turned into twilight, with the corona providing enough light to prevent total darkness. Some bright stars and possibly a planet or two pop into view in the blue-black sky. The horizon in all directions, being outside of the Moon's shadow, glows with sunset colors of orange and yellow.

Peel your eyes away from the eclipsed Sun for a few seconds (if you can), and take in the sights and sounds of your surroundings. Others have reported phenomena like flowers closing up their petals as they normally would at dusk, then reopening them once totality has ended. Cattle saunter back to the barn like they do at nightfall. Birds may roost, singing their evening choruses as the light dims before totality, then go silent when the Sun blots out. Nocturnal animals like bats and owls may wake up and take to the sky. Evening insects start to chirp. Do you notice anything strange or interesting about the behavior of flora and fauna where you are?



Mid-totality

Third Contact: Totality Ends

Before you know it, the end of totality is just seconds away. A second diamond ring bursts into view, this time on the Moon's trailing side, as the corona fades out. The chromosphere and more Baily's Beads make a final, fleeting appearance. When they blink off, you've reached *Third Contact*.

NOW PUT YOUR ECLIPSE GLASSES AND YOUR INSTRUMENT'S SOLAR FILTER BACK ON (if you will continue to view the Sun)!

Thus ends the main act of Nature's Greatest Show on Earth. Now the super-bright edge of the solar disk peeks out and the sky immediately brightens. Cheers and applause will ring out from the thrilled, gobsmacked masses.

Quickly look to the east (with eclipse glasses off). Can you see the Moon's shadow racing away? Look down once more to try to catch shadow bands fluttering on the ground. Check out your shadow if you didn't do so right before totality. Do you see how unusually sharp it is? Also check your thermometer; how much did the temperature drop during totality?

Fourth Contact: It's Over

It will be about another hour before *Fourth Contact*, when the Moon moves completely past the Sun's disk, marking the official end of the solar eclipse.



Use Eye Protection!

In a total solar eclipse, it is safe to directly view the Sun only during the brief period of totality, when the Sun's disk is *completely* covered. Before and after totality, when the Sun's disk is only partially eclipsed, you must use specialized, certified-safe "eclipse glasses" or a safe solar filter if viewing through a telescope or binoculars—to prevent serious eye damage. Be sure also to cover your telescope's finder scope with its cap. *(Note: Meade does not offer eclipse glasses.)*

Using Binoculars or a Telescope

Binoculars will offer good views of the corona at totality, their wide field of view and modest magnifying power revealing tapered streamers, polar brushes (feathery rays that stick out from the Moon's disk), and pinkish prominences. For all phases of the eclipse *except* for totality, the binoculars must be fitted with a pair of certified solar filters, to prevent damage to your eyes.

A telescope will provide a detailed, magnified view of totality. (Make sure your solar filter is **OFF** the telescope during totality, or you won't see anything!) It can bring out fine "structure" in the Sun's corona: luminous threadlike rays, streamers, and arcing plumes that extend from the Moon's limb. It will also provide higher-resolution images of solar prominences, better showing their color, shape, and extent.



For direct viewing of the partial phases of the eclipse, you must use a certified solar filter fitted securely on the front of your telescope. A "white-light" solar filter, which is made from glass or a special film polymer such as Mylar[®] polyester film, blocks 99.999% of incoming sunlight so you can safely observe the Sun without damaging your eyes or the telescope. With a white-light filter you can see sunspots, which appear as dark splotches on the Sun's photosphere, and faculae, which are bright regions. On close inspection you may even resolve some surface "granulation." Each tiny granule as seen from Earth is actually a cell of Texas-sized hot, ionized gas that rises up from deep inside the Sun, then cools and falls back down.



Hydrogen-Alpha Solar Telescopes

Some telescopes are specially designed for safe, ultra high-resolution viewing of the Sun. Hydrogen-alpha telescopes and filters reject all light except that in a narrow portion of the electromagnetic spectrum around the red H-alpha line, at 656 nanometers. With an H-alpha telescope, the Sun's disk springs to life with mesmerizing phenomena and detail. You're seeing the Sun's chromosphere, the atmospheric layer just above the bright and (in normal light) overpowering photosphere. Spicules, shape-shifting prominences, snakelike filaments, fibrils, bright plages, and dramatic flares burst into view across the Sun's disk through an H-alpha telescope or filter.

An H-alpha solar telescope or filter will, however, block the view of the corona during totality. So that's when you will want to look up from the telescope or look into a standard telescope with any solar filter removed.

We hope you enjoy this rare celestial spectacle and that it sears indelibly into your memory (it will)! Because the next total solar eclipses visible from the continental United States will not occur until August 23rd, 2044 (in parts of Montana and N. Dakota only) and August 12th, 2045 (in parts of 13 states).

Good luck, view safely, and clear skies!

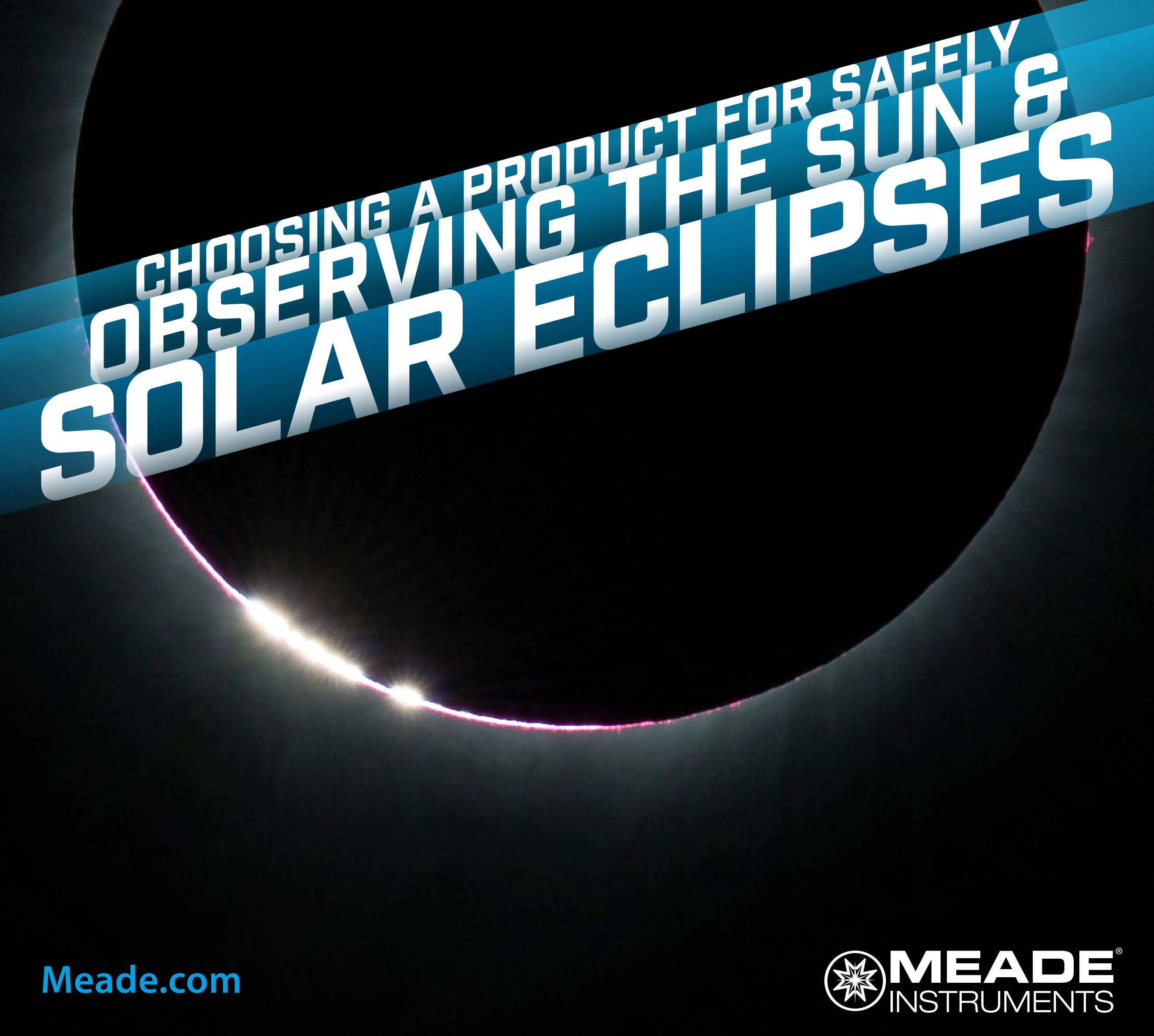
Browse our selection of Meade White-Light Solar Filters and Coronado H-alpha Solar Telescopes and Filters at Meade.com/solar.idx.

These Items Are *NOT* Safe for Eclipse Viewing!

- Sunglasses or stacked pairs of sunglasses
- Photographic neutral-density filters
- Photographic UV filters
- Polarizing filters
- Smoked glass
- Compact discs
- Metallic food/candy wrappers

These items may reduce the Sun's brightness, but they do not completely block infrared and ultraviolet wavelengths, which are harmful to your eyes.

PRODUCT GUIDE



Choosing a Product for Safely Observing the Sun and Solar Eclipses

To witness any solar eclipse, you will need to consider what type of product to use to both protect your eyes and provide the type of observing experience you want for the special events. Meade provides eclipse viewing solutions for any level of Sun-watching sophistication, from first-timers to experienced eclipse chasers.

Solar Eclipse Glasses

The least expensive type of eye protection commonly used for solar eclipse viewing is solar eclipse glasses. Although Meade does not offer them, they are widely available from many other retailers. Eclipse glasses are eyeglasses with cardboard (usually) or plastic frames and polymer-type solar filters for "lenses". Fashion forward eyewear they are not, given their clunky one-size-fits-all design, but they are easy to pop on and off and are relatively comfortable to wear because they are so lightweight. They provide a non-magnified view of the Sun, which means you will be able to see sunspots if they are very large (and your eyesight is very good). Keep in mind that with eclipse glasses you will not be able to see anything except the Sun.

Solar eclipse glasses are handy for safely viewing both total and annular solar eclipses, including the partial phases of solar eclipses.

Make sure to select only eclipse glasses that are ISO 12312-2 certified.





Advantages:



Inexpensive; easy to use; shows larger sunspots; allows safe viewing of Sun anytime, including during solar eclipses

Non-magnifying so minimal solar detail visible; some on market may not meet ISO safety standard



Meade Full-Aperture Glass Solar Filters

Meade offers ISO-certified Glass Solar Filters designed to fit popular Meade telescopes of various sizes. These are "white light", visible-spectrum solar filters designed for viewing and imaging the Sun. The filters are made from glass coated with a reflective material that blocks 99.999% of sunlight, which allows for safe viewing. The Sun is displayed in a yellow-orange color. With a white-light filter you can see sunspots, which appear as dark splotches on the Sun's photosphere, and faculae, which are bright regions. On close inspection you may even resolve some surface "granulation."

Meade assures that all our solar filters are tested at specialized labs that are accredited to verify compliance with the ISO 12312-2 safety specifications for solar viewing. Designed and manufactured in the USA, each filter has a brushed aluminum mounting cell and many have three nylon thumbscrews to ensure secure attachment of the filter over the front aperture of the instrument.

Be forewarned that due to high demand, supplies of Meade Full-Aperture Glass Solar Filters could run out in the weeks leading up to the two North American Solar Eclipses, so don't wait to order yours from an authorized Meade reseller!

Advantages:

Shows Sun in yellow-orange color; sizes to fit many different telescopes and binoculars; made in USA; ISO 12312-2 certified for safe solar viewing and imaging



Does not show as much solar detail as more-specialized H-alpha filters



Meade ETX Eclipse Plus Telescope Kits

With a telescope you will enjoy a detailed, highly magnified view of the total or annular solar eclipses. The magnifying power will depend on the focal length of the particular telescope—longer focal lengths provide greater magnification—but any telescope will let you get in tight to see fine "structure" in

the Sun's corona during a total solar eclipse, and will let you glimpse Baily's beads, the Diamond Ring effect, and flame-like solar prominences on the Sun's chromosphere in stunning resolution. For annular eclipses a telescope fitted with a white-light solar filter will resolve sunspots large and small and the bright faculae that surround them during the partial phases, and will reveal surface granulation better than binoculars can.

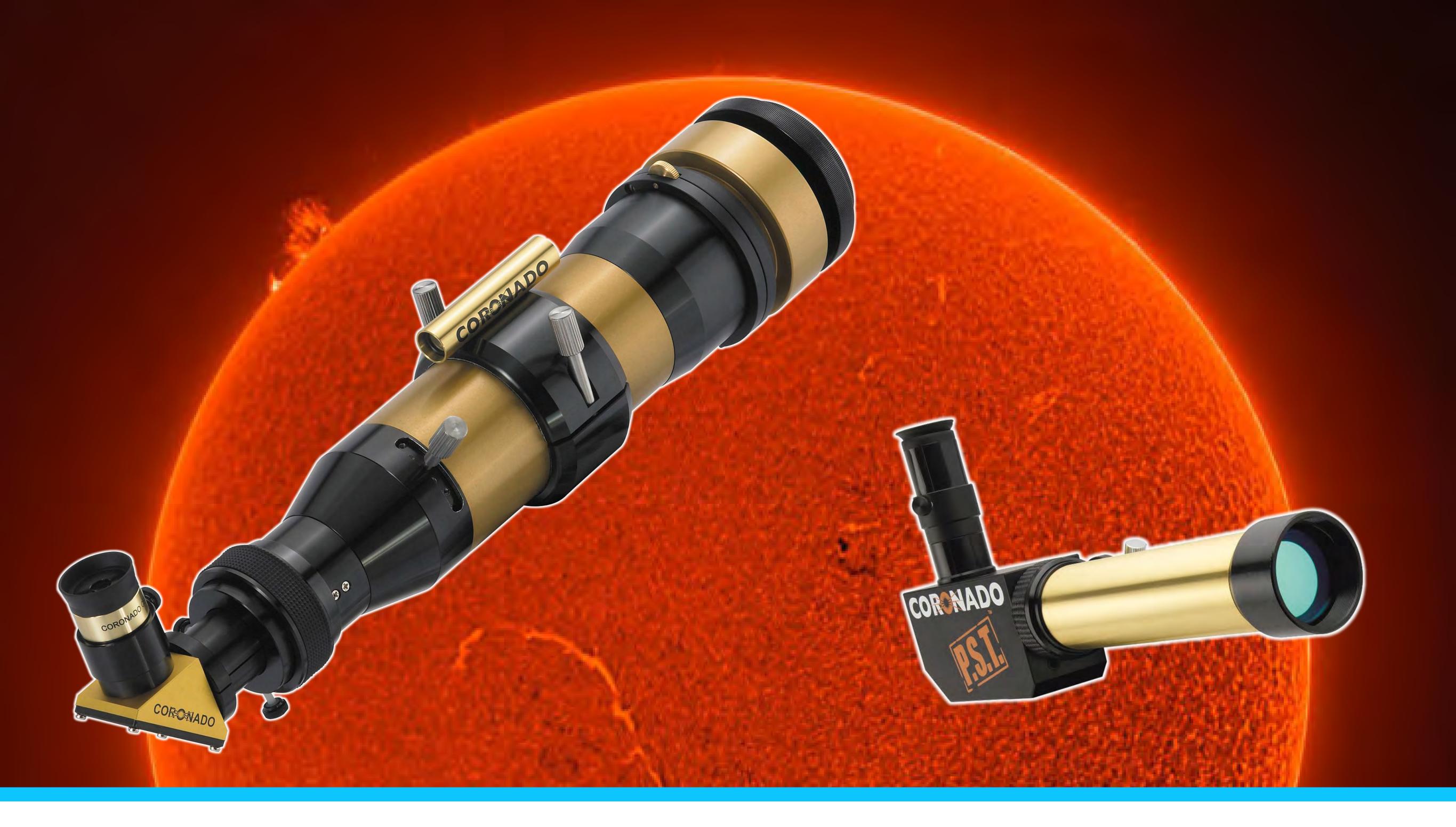
To help eclipse watchers get the most out of the upcoming solar eclipse events, Meade is offering special ETX Eclipse-Plus Telescope Kits. The kits bundle the iconic Meade ETX 90mm and 125mm GoTo Maksutov-Cassegrain telescopes with a made-in-USA Orion Safety Film Solar Filter to allow you to view the Sun through the telescope safely. Safety Film Solar Filters are white-light filters that use a durable film-like material to block 99.999% of the Sun's radiation to protect your vision. Each kit includes everything you'll need to experience the North American Annular and Total Solar Eclipses up close and in eye-widening detail. We also include a Meade Series 4000 1.25" Moon Filter for detailed, reduced-glare lunar observation year-round, and a smartphone photo adapter for taking steady, dazzling shots of the Moon and more with your phone.

Advantages:

Complete ETX telescope packages; high-magnification views of eclipse phenomena; includes white-light Sun filter and Moon filter; during total eclipse totality phase, solar filter can be removed to see the corona, chromosphere, and prominences; use the ETX for highresolution astronomical viewing throughout the year; quality family time under the stars!

Disadvantages:

White-light solar filter shows limited solar features and detail compared to H-alpha telescopes



Coronado H-Alpha Solar Telescopes

Designed exclusively for safe, ultra high-resolution viewing of the Sun, hydrogen-alpha telescopes take solar viewing to the next level. "H-alpha" telescopes are refractor-type telescopes that use specialized filters that reject all light except that in a narrow portion of the electromagnetic spectrum around the red hydrogen-alpha wavelength, at 656 nanometers. With an H-alpha telescope, the Sun's disk springs to life with mesmerizing phenomena and detail. You're seeing the Sun's chromosphere, the atmospheric layer just above the bright and (in normal light) overpowering photosphere. Spicules, shape-shifting prominences, snake-like filaments, fibrils, bright plages, and dramatic flares burst into view across the Sun's disk through an H-alpha telescope. Surface "granulation" is also much better resolved in an H-alpha telescope than with white-light filters.

Coronado H-alpha solar telescopes provide breathtaking views of the Sun's surface and its dynamic features. They will reveal incredible, ever-changing solar detail and phenomena rear-round. During a total solar eclipse they will cut through the bright photosphere to show features on the chromosphere during the partial phases. During totality, however, H-alpha telescopes with built-in filters will block the view of the Sun's white corona. Some Coronado H-alpha telescopes do have removable filters to allow use of the telescope as a normal refractor for nighttime astronomy.

H-alpha solar telescopes are typically sold as optical tube only, so you will need a telescope mount, which is sold separately, to support it. Coronado H-alpha solar telescopes come in a range of apertures and prices.



Advantages:

Shows phenomena on Sun's chromosphere that can't be seen with a regular telescope equipped with white-light filter; some models have removable H-alpha filters so the telescope can be used as a regular refractor for nighttime astronomy

Disadvantages:

Expensive; usually sold as telescope tube only, which requires telescope mount/tripod (sold separately); prior telescope experience recommended; some models limited to solar viewing only; during totality phase of total solar eclipse, cannot see corona

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