HANDOUTS FOR "TEXAS NEXUS: DON'T MISS THE ECLIPSES"

CAST meeting, Dallas TX
Thursday 2:30pm November 10 (Peacock Terrace)
And Friday, 2:00 pm, November 11 (Coronado A)

Presented by Prof. Patricia Reiff, Dept of Physics & Astronomy, Rice University
And Dr. Carolyn Sumners, Vice President for Astronomy and Physical Science, Houston Museum of Natural Science.

Contents:

1. Poster: Don't miss the Eclipses
2. Poster: Texas Nexus eclipse map
3. Website: https://space.rice.edu/eclipse for links to materials, graphics, games, citizen science activities and the powerpoint shown.
4. Solar Eclipse FAQ
5. Safe Solar Observing (Rice)
6. Solar Eclipse safe observing (from NASA) – English
7. Solar Eclipse safe observing (from NASA) – Spanish
8. NASA Solar eclipse flyer (MSFC)
9. Temperature and animal charts

reiff@rice.edu

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TEXAS NEXUS

ANNUAL
OCT 14, 2023

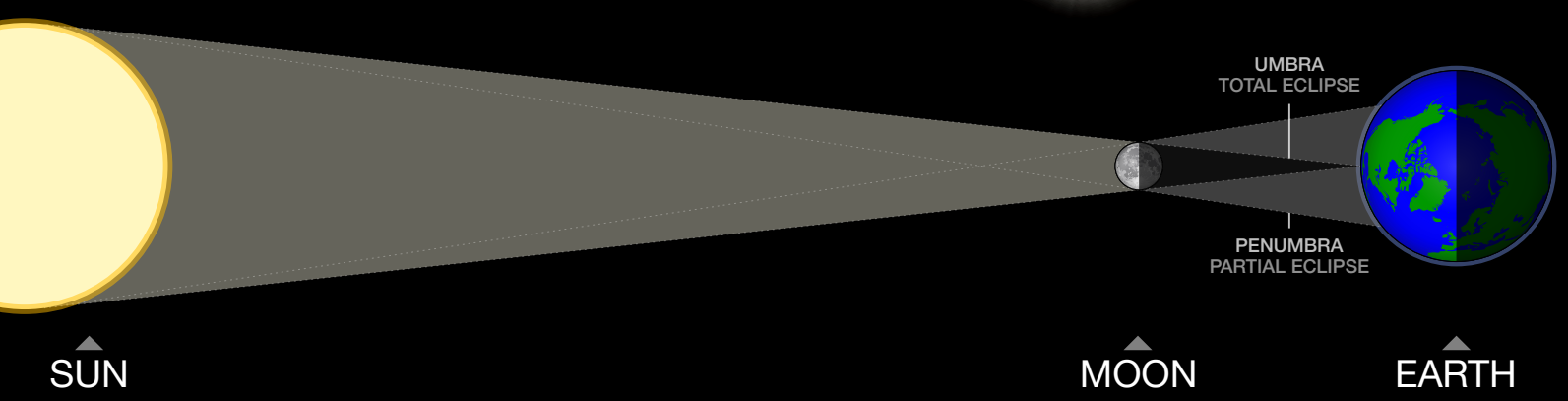
TOTAL
APR 8, 2024

DON'T MISS THE ECLIPSES

ANNULAR ECLIPSE
OCTOBER 14, 2023

(SIZE AND DISTANCE NOT TO SCALE)

TOTAL ECLIPSE
APRIL 8, 2024



(SIZE AND DISTANCE NOT TO SCALE)

TEXAS NEXUS

ANNULAR ECLIPSE
OCTOBER 14, 2023

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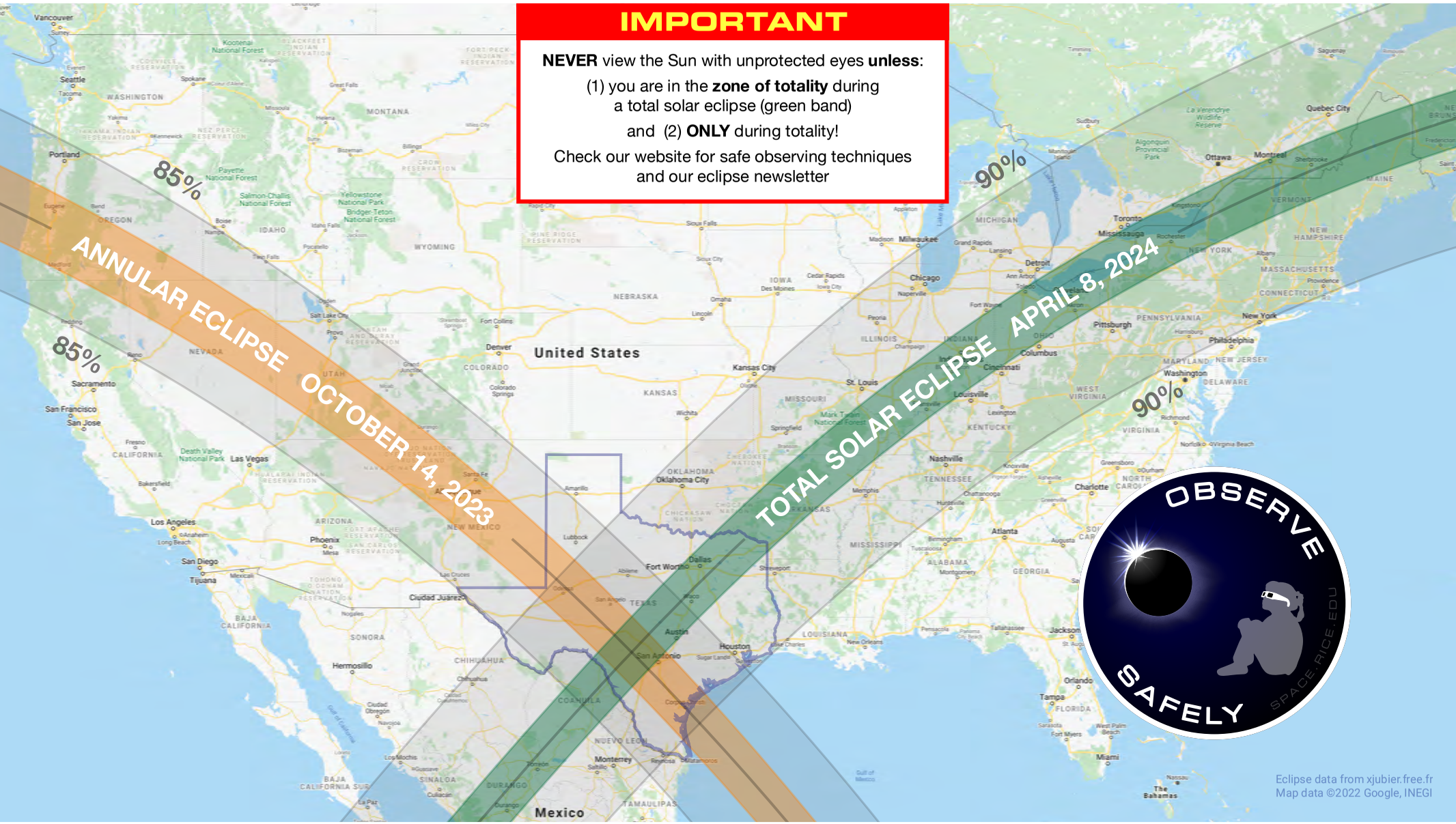
APRIL 8, 2024



All information is courtesy
Rice University, NASA HEAT and Discovery Dome

Sign up for our eclipse newsletter:
bit.ly/RiceEclipse

For more information:
SPACE.RICE.EDU/ECLIPSE

Links to Texas sites in totality:
TEXASECLIPSE.NET

Eclipses

This site contains info, educational resources, and animations about eclipses.

- **Sign up** for the Rice Space Institute **ECLIPSE NEWSLETTER**
- Visit our **Texas Eclipse Activation Network** site where you can find information on potential viewing sites in Texas for the upcoming eclipses of 2023-2024.

Upcoming Eclipses in the Americas

October 14, 2023 Annular solar eclipse | CREDIT: greatamericaneclipse.com

April 8, 2024 Total solar eclipse | **README**

CLUSTER Outreach

CUWiP Meeting 2017

Dome Loaner Program

Future Space

IMAGE Outreach

Immersive Earth

Museums Teaching Planet Earth

Programs for Teachers

Mailing lists

MST Program

Space Weather

Space Weather : Forecast

Space Weather : Realtime

Space Weather : Resources

Space Science at Rice

SPAC Alumni

Rice Physics & Astronomy

Rice Space Institute

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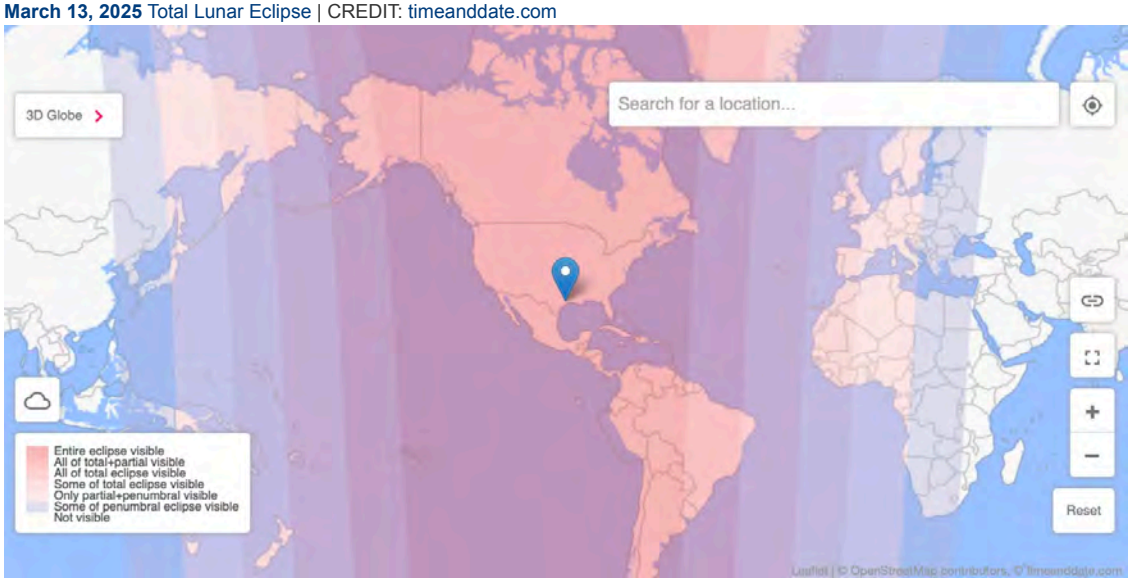
Houston, TX 77005-1892

March 13, 2025 Total Lunar Eclipse | CREDIT: timeanddate.com



Solar Eclipse FAQ

Courtesy Prof. Patricia Reiff, the Rice Space Institute
http://space.rice.edu/eclipse

1. Why does a solar eclipse only happen during new moon?
2. Why don't we have a solar eclipse every month?
3. What is the difference between a partial solar eclipse and a total solar eclipse?
4. When is the next solar eclipse?
5. Does the time of the eclipse depend on where on Earth I am?
6. What is an "annular" eclipse?
7. What would you see if you were standing on the Moon when the Earth experiences a total solar eclipse?
8. Why is a total eclipse so much more special than a partial or annular eclipse?
9. Are all total eclipses the same?
10. Are solar eclipses safe to view with the naked eye?
11. Where should I go to see a total eclipse?

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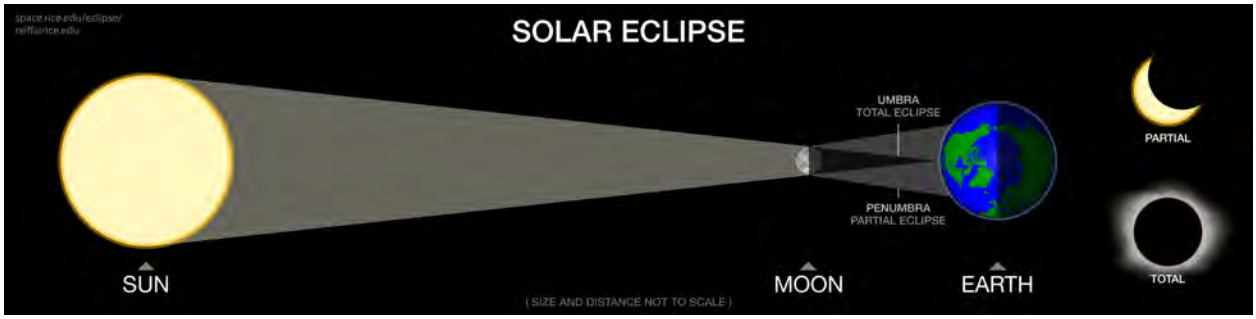
1. Why does a solar eclipse only happen during new moon?

Only during full moon and new moon is the Moon in a line with the Earth and Sun. If the Earth is in the middle, the Moon is *full* and fully lit by the sun. Only then, if the alignment is perfect, we get lunar eclipses [the Earth's shadow falling on the Moon]; if the Moon is in the middle, the Moon is *new* (we see only the dark side) and, if the alignment is perfect, we get solar eclipses [the Moon's shadow falling on the Earth].



2. Why don't we have a solar eclipse every month?

The plane of the Moon's orbit around the Earth is not exactly the same as the plane of the Earth's orbit around the Sun, so the Moon (as seen from the Earth) generally passes over or under the Sun during times of new Moon. Only twice a year, when the orbits cross, at the "nodes", are eclipses possible, called "eclipse seasons"; even then, the Moon also has to be in the right place in its orbit to yield an eclipse. There will generally be at least one partial solar eclipse each year, but there can be more. If there is a total solar eclipse that season, then there must be at least a partial lunar eclipse two weeks earlier or two weeks later.

3. What is the difference between a partial solar eclipse and a total solar eclipse?

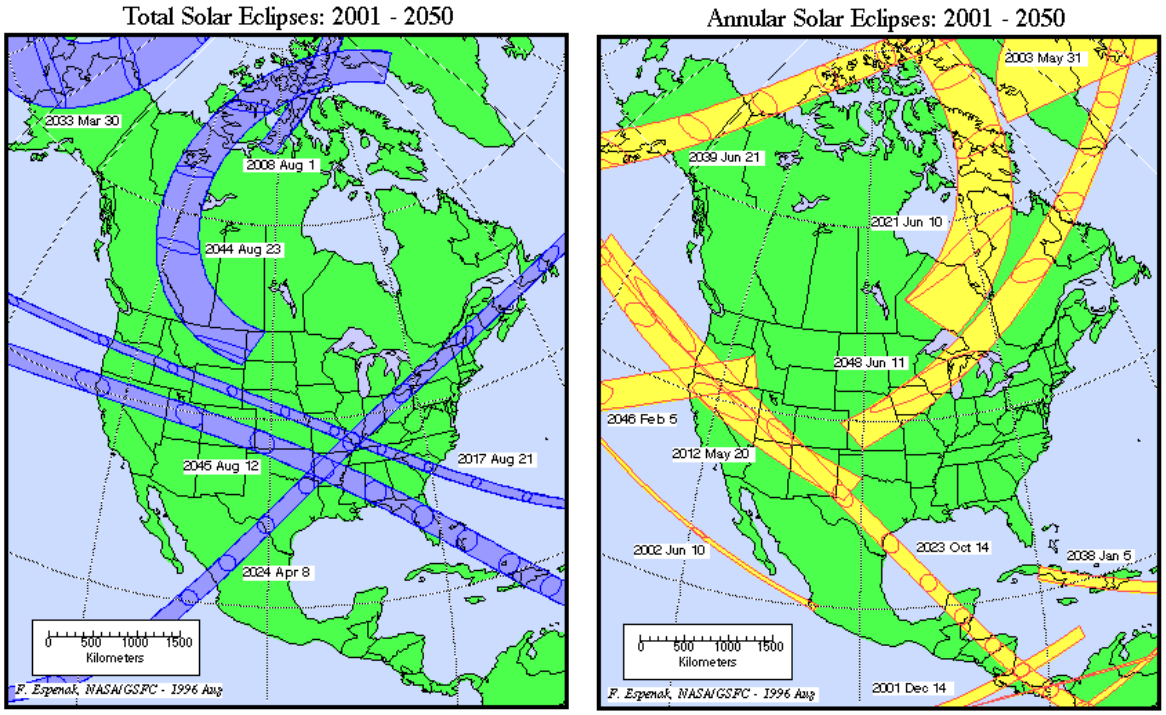
In a partial eclipse, the sun is only partially covered by the Moon, so the viewer is in the penumbra - the shadow of the moon that is not so deep. In that case, you don't get to see the Sun's corona (which is only visible during totality). Even in a total eclipse, there is about an hour of "partial phase" (as more and more

of the Sun is being progressively covered) before the totality (which only lasts for a few seconds to a few minutes), and then another partial phase as the Moon continues its motion and uncovers the Sun again. The moon moves about 12 degrees a day through the sky, so it takes an hour to move its angular diameter (about a half-degree).

4. When is the next solar eclipse?

- Find out the next lunar or solar eclipse at your location here: **https://TimeAndDate.com/eclipse**
- Another great place is Goddard Space Flight Center: **https://eclipse.gsfc.nasa.gov/solar.html**.
- Xavier Jubier maintains an excellent eclipse site with maps at **http://xjubier.free.fr/en/site_pages/Solar_Eclipses.html**.

In the continental US we will have total solar eclipses in 2024 and 2045 (see image at GSFC) and annular eclipses in 2023, 2046 and 2048, plus partial eclipses. However, there are total eclipses visible somewhere on Earth at least every other year. To calculate the eclipses near you, NASA created a **javascript eclipse calculator** - just enter the latitude and longitude and it will give you the times and percent coverage of the Sun for any location on Earth.



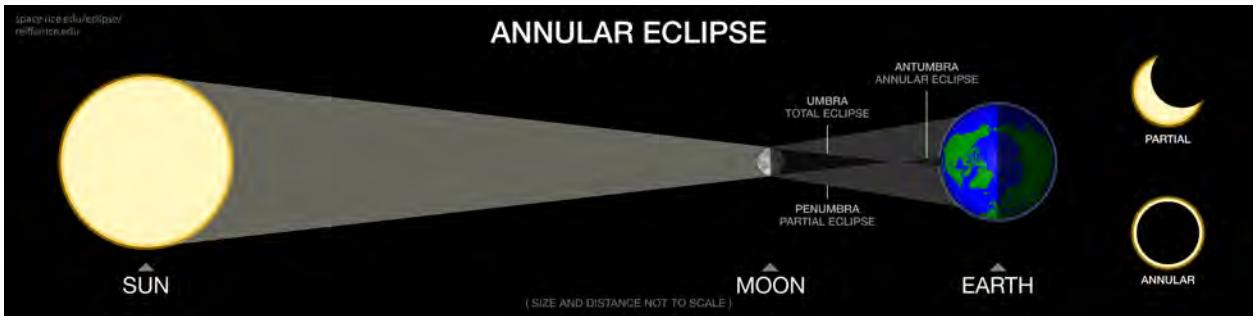
5. Does the time of the eclipse depend on where on Earth I am?

Definitely! Since the Moon is relatively small and far away, only a narrow stripe across the Earth will be in the umbra, the part of the Moon's shadow with the Sun completely covered. The people near that, but outside the "path of totality", will only see a partial eclipse. The shadow travels across space very fast, at the speed of the Moon's orbit around the Earth (2288 mph, or 3683 km per hour, generally from West toe Earth), but the Earth itself is also rotating (about 1000 mph at the equator), so the effective speed across the surface is less and varies with each eclipse, but always more than 1000 mph. So it takes a few hours for the eclipse to cross the Earth's surface. For eclipses which occur near noon local time, the approach of the column of the "Moon shadow" is very dramatic! Some, however, will miss the beginning of the

eclipse because it starts before their sunrise, or miss the end of the eclipse because it ends after their sunset.

6. What is an "annular" eclipse?

On average, the Moon is actually a little too small to completely cover the Sun. The Moon's angular size in the sky varies by 5.5% because its orbit around the Earth is actually an ellipse. Similarly, the Sun's angular size in the sky varies by about 1.7% because the Earth's orbit is an ellipse, also. When the Moon is closer than average, or the Sun is farther than average, we get total eclipses. When the Moon is farther than average or the Sun is closer than average, we get "annular" eclipses. In that case, even though the Moon is in perfect alignment, there is still a ring of sunlight visible - the annulus. Annular eclipses are not safe to view with the naked eye or with telescopes without special protection.



7. What would you see if you were standing on the Moon when the Earth experiences a total solar eclipse?

From the Moon, you can see the Moon's shadow crossing the Earth. This is the story of our planetarium show "Earth's Wild Ride" http://www.eplanetarium.com/shows/ddome/earths_wild_ride/ that you can watch free from our website. Here is a photo from the Mir spacecraft for the 1999 eclipse:

8. Why is a total eclipse so much more special than a partial or annular eclipse?
Only for the fortunate few in the path of totality will the Moon cover all of the bright part of the Sun, allowing the "corona", the glowing halo, to show through. It is not visible in partial eclipses (even 95%!) or in annular eclipses, because the sun is so very bright. Spacecraft can make artificial eclipses in space because there is no atmosphere to scatter the bright light of the Sun. Another gorgeous part of of a total eclipse is the "diamond ring" when only a tiny part of the sun is not covered. These diamond ring photos are from Max Garrick in 2010 Polynesia, and from Brian Verkaart in Australia in 2012.

9. Are all total eclipses the same?
No, during solar maximum the corona is brighter and is more symmetric. There may be more prominences (red loops on the edge shining in Hydrogen-alpha light). The photo below shows the coronas from two eclipses, one near solar maximum (2012) and one near solar minimum (2009) photo courtesy

Ken Offit, Australia 2012. During solar minimum, the corona has more extended structures near the solar equator and coronal holes with nearly vertical magnetic field lines near the poles.

10. Are solar eclipses safe to view with the naked eye?
NO! Solar eclipses are DANGEROUS except for the lucky ones in the path of totality, and only while the eclipse is **TOTAL - ONLY THEN** is it safe to view with your naked eyes, binoculars, and telescopes. Never point a telescope or binoculars towards the Sun unless it has a special filter on the FRONT (sun-side), not just over the eyepiece. For partial or annular solar eclipses, you have to use special eye protection or special camera filters. You can use pinhole projection, special "eclipse glasses", or welder's glass #14. (NASA website on safe observing: http://eclipse.gsfc.nasa.gov/SEhelp/safety2.html). Safe, but silly, eclipse glasses are demonstrated in this photo from 2010.

The reason why eclipses are more dangerous than just looking at the Sun on a normal day is that your blink reflex doesn't work as well when the sky is dark – the partially eclipsed Sun seems darker but each uncovered piece of it is just as bright as normal and can burn an image of the crescent sun on your retina, especially if you are looking through a telescope or binoculars! Eclipses are NOT hazardous to pregnant women, despite customs in some societies

11. Where should I go to a total eclipse?

If you haven't ventured to a total solar eclipse, go if you can – it is one of nature's most wonderful marvels! There are many tours that specialize in eclipses: http://www.eclipsetours.com is the one I am frequently the science advisor on. There is a website just for American eclipses at http://www.greatamericaneclipse.com/

Credits: Thanks to Colin Law for the eclipse diagrams (his time paid for by NASA MMS education program http://mms.rice.edu). Also thank various websites (listed) for imagery.

Safe Eclipse Observing

Prof. Patricia Reiff, Rice University

Some of my favorite safe ways to observe the Eclipse (or the sun, any time). These are generally listed in order of expense, cheapest first.

1. Observe Safely!

For the latest safety information, please check our site (space.rice.edu/eclipse)
Or: solarsystem.nasa.gov/eclipses/safety/ (NASA)
Or eclipse.aas.org/eye-safety (AAS)

Here are links to the NASA safety flyer:
space.rice.edu/eclipse/pdf/evergreen_eclipse_flyer_english.pdf
space.rice.edu/eclipse/pdf/evergreen_eclipse_flyer_spanish.pdf

2. Pinhole projection.

A. Get a cardboard box. Punch a hole into one of the ends (I use one of the smaller ends to make a longer path so a bigger image). Since the cardboard may have ragged edges from the punched hole, I generally just make the cardboard hole larger and then cover it up with a piece of thick paper and punch a smaller hole in it. Put a sheet of white paper into the opposite end. You may need to tilt the box, propping it up, to see the image.

B. For a brighter image, if you just make the pinhole larger, it will get fuzzy. Instead, make a larger hole but use a pair of inexpensive reading glasses to focus the image inside the box. The image still won't be very large, but it will be brighter and in better focus. You may need to adjust the placement of the box (the best strength of the reader depends on the length of the box: 2 or 2.5 magnification works well with a 14-16 inch box).

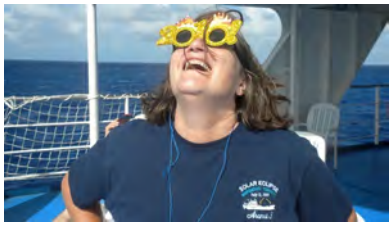
C. This shows the image inside the box – small, but you can watch the progression of the eclipse.

D. My favorite way to do a pinhole is to take a piece of STIFF cardboard and punch holes in it, describing the date and location. Then take a photo of its SHADOW. Each hole makes a crescent eclipse! Get it ready the night before (a fun kid's activity), and then photograph just after totality.

3. Eclipse Glasses:

A. Eclipse glasses are a safe and inexpensive way to observe the eclipse. Be sure you get them from a reputable source, that have the "CE" or "ISO" certification marked on them. I like the ones from Rainbow Symphony since they give a pleasing orange colored sun. You can use them to observe sunspots at any time! Protect them from scratches or holes.

B. Although eclipse glasses are easy and fun, they do not magnify the sun. You can tell the progression of the eclipse, but you generally won't be able to see any sunspots, unless the spots are extra large.



4. Solar Filters

A. For me, the most comfortable and natural view of a total eclipse (solar or lunar) is from a pair of binoculars mounted on a tripod. You can use the shadow of the binoculars to do a rough alignment (minimizing the size of the shadow), then look through the FILTERED binoculars to find the sun. Zoom out to find the sun, then zoom in to get a better view. Have a stepstool on hand so children can take a peek too. By putting on the tripod, several people can share the view without each having to "find" the sun (not easy using filtered binoculars!). I prefer a 10-22 zoom, 50 mm diameter binoculars… good quality but not too expensive. (You can get cheap ones for $30 but I prefer the good ones for $150). Solar ND (neutral density) filters are also available for larger telescopes. Always put the filter on the OBJECTIVE end of the telescope, **never** on the eyepiece.

B. There are two critical pieces of equipment: The solar filters ($20 each) that cap the binoculars (I like the ones at Rainbow Symphony so I can slip them on and off easily) https://www.rainbowsymphonystore.com/collections/solar-filters

Measure the OUTSIDE diameter of your binoculars, telescope, videocamera, or camera lens, and get the next LARGER size. They provide foam tape for a snug fit… you don't want them to fall off, but you do want them to come off easily when totality hits!

The second critical item is the "Binocular tripod adapter" - purchase from a photo or telescope store or from Amazon. Prices range from $9 to $28. One end screws into the mounting hole on the hinge of your binoculars (which might be covered by a cap). Mount the flat end onto your photographic tripod. This gives you full control of the direction that the binoculars are pointing. This is really good for observing the sun (or other astronomical objects - you only need the solar filters for observing the sun). However, if the Sun is very high in the sky, it becomes awkward to look through binoculars on a tripod - see binocular projection below.

C. Finding the sun in filtered binoculars is harder than you might think - the only thing you can see is the sun! Don't "sneak a peek" - it can kill your vision! To find the MOON in the sky, or a bird in a tree, with binoculars, first look at it directly with your eyes straight ahead (moving your head till you are facing it squarely). THEN put the binoculars (zoomed OUT for minimum magnification) up to your face and the object should be in (or near) the field of view. Then zoom in. The procedure to find the SUN is similar BUT you have to do it with your EYES CLOSED. Close your eyes and move your head around until you feel the sun's heat on your face and you think you are facing straight at it. Then bring up the FILTERED binoculars (zoomed OUT) and open your eyes. Again it should be in or near your field of view.

D. If you can't find the sun, often a friend can see the shadow of the binoculars on your face and tell you to tip back, or left, or whatever. Here I am looking at the Sun near local noon in May, near the elevation of the eclipse in January. I got a good view but it is really tough on your neck to hold it for very long.

5. Binocular projection

A. When the sun is high in the sky, the most comfortable view is using a pair of binoculars to project an image. Put the binoculars on a photographic tripod, using a "binocular tripod adapter" - see 4B above. Cover one lens of the binocular with its cap or with a solar filter but leave the other lens uncovered. **NEVER LOOK AT THE SUN THROUGH BINOCULARS WITHOUT THE SOLAR FILTER ON! NEVER LEAVE THIS SETUP UNATTENDED - SOMEONE MIGHT TRY TO LOOK THROUGH THE BINOCULARS!** I put the tripod on its LOWEST (shortest) setting to make it hard for someone to try to look through the binoculars - that also makes the image the brightest. Adjust the tip and rotation of the tripod head to make the shadow of the binoculars the smallest possible… then it will be looking exactly at the sun. Ideally, adjust the look direction slightly to project the image into a shadowed area, if one is handy (see photo). Put a piece of heavy white cardboard to project the image onto, or tape a white piece of paper onto something heavy. Tip the paper so it is perpendicular to the line of sight, so that the sun's image is a circle, not an oval. Use the zoom and focus adjustments on the binoculars to make the best view. For a large diameter binoculars, you can get an image 3 inches across or more.

B. If you don't have a shaded area nearby, you can make your own shade. Here are some smaller binoculars on a small tripod. Again use the shadow of the binocs to align. See the image of the Sun on the paper near the shadow of the binoculars.

C. Wrap a dark sheet or towel around the binoculars, keeping only the uncovered aperture in the sunlight. The towel will make a shadow that you can keep the image in. As the earth rotates, you will need to adjust the pointing of the binoculars to keep the image in the shadow.

You can also use an inexpensive telescope to project an image of the Sun, in a similar way to the binoculars. If the Sun is nearly vertical, a spotting scope is best for projection, again using the shadow to align. (NEVER look through a telescope at the sun without a solar filter). You can also one with a "star diagonal" to project onto a wall, but in that case you must be extra careful that someone doesn't try to look through the eyepiece.

6. Sunspotters

A. The safest way to get a big image of the sun is through a commercial "Sunspotter®" device from Science First. It's not cheap (around $400), but it is well designed and can be used to sketch sunspots at any time, not just during eclipses. (http://shop.sciencefirst.com/starlab/models/5818-sunspotter.html). To align, first move the device around (sliding the triangular assembly up and down and rotating the whole thing so that the shadow of the peg - above the "p" in "Sunspotter" - is minimized.) Then a white dot should appear near the white circle (lower right). If the device is aligned, putting the white dot into the white circle should give you a solar image on the white paper. Mine is a little off but it is close enough to find the sun. You can adjust the focus if necessary but mine is usually just fine.

B. The Sunspotter even works with the sun nearly directly overhead. Another advantage of using a sunspotter is that a young person or student can be in charge of keeping it aligned… there is no way to look at the sun directly through it so it is always safe.

7. H-alpha Telescope

The most expensive way to observe the sun is through a Hydrogen Alpha telescope. Instead of filtering out all of the different wavelengths of light equally, it selectively admits only the red light (656 nm) which is emitted by a Hydrogen atom near the visible surface of the sun. You can observe the Sun's prominences, convection cells, and plages any time - not just during an eclipse. By slightly adjusting the wavelength, you can adjust the height of the features that are best seen. Less expensive models use photographic tripods. More expensive models have motors for tracking the sun across the sky. I own a 40mm Coronado and I find it can be tricky to keep the sun in the field of view without the tracking motor.

Note: All images taken by Patricia Reiff (reiff@rice.edu). Permission is granted to print out and distribute this for non-commercial educational use. Disclaimer: I have no commercial interest in any of these products (I have purchased these products personally and am a happy customer); however I do sell eclipse glasses through my company's online store https://eplanetarium.com/store

National Aeronautics and Space Administration

Experience a Solar Eclipse


Credit: S. Habbal, M. Druckmüller and P. Aniol

WHAT IS A SOLAR ECLIPSE?

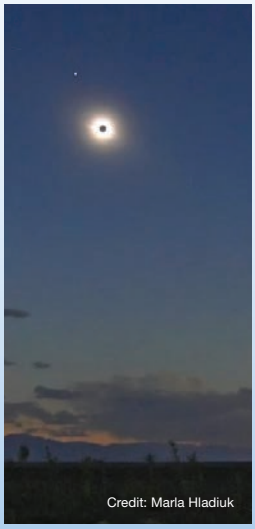
A solar eclipse happens when the Moon moves between the Sun and Earth, casting a shadow on Earth, fully or partially blocking the Sun's light in some areas. There are different types of solar eclipses.

Total Solar Eclipse
For a total eclipse to take place, the Sun, Moon, and Earth must be in a direct line. The people who see the total eclipse are in the center of the Moon's shadow when it hits Earth. The sky will become very dark, as if it were night. Weather permitting, people in the path of a total solar eclipse can see the Sun's corona, the outer atmosphere of the Sun. A total solar eclipse is the only type of solar eclipse where viewers can watch without their eclipse glasses – and they can only remove them when the Moon is completely blocking the Sun.

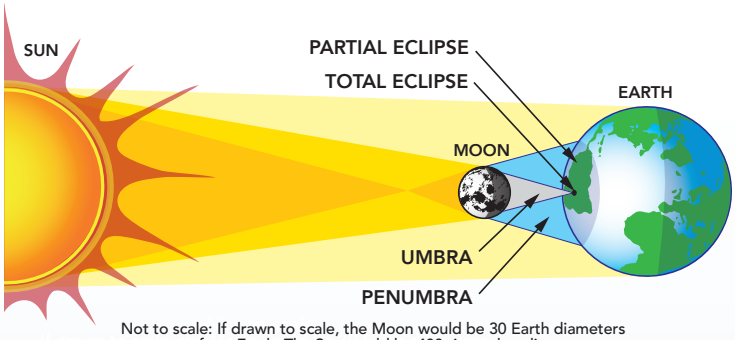
Annular Solar Eclipse
An annular eclipse happens when the Moon is lined up between the Sun and Earth, but at its farthest point from Earth. Because the Moon is farther away from Earth, it seems smaller. It does not block the entire view of the Sun. The Moon in front of the Sun will look like a dark disk on top of a larger, bright disk. This creates what looks like a ring around the Moon.

Known as a hybrid eclipse, sometimes an eclipse can shift between annular and total as the Moon's shadow moves across Earth's surface.

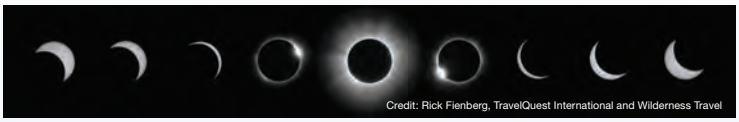
Partial Solar Eclipse
This happens when the Sun, Moon and Earth are not exactly lined up. The Sun will appear to have a dark shadow on only part of its surface. During a total or annular solar eclipse, people outside the Moon's inner shadow see a partial solar eclipse.


Credit: Marla Hladiuk

TOTAL SOLAR ECLIPSE



Not to scale: If drawn to scale, the Moon would be 30 Earth diameters away from Earth. The Sun would be 400 times that distance.


Credit: Rick Fienberg, TravelQuest International and Wilderness Travel

In this series of stills from 2013, the eclipse sequence runs from right to left. The center image shows totality; on either side are the 2nd contact (right) and 3rd contact (left) diamond rings that mark the beginning and end of totality respectively.

WHERE TO WATCH
Find a nice, clear spot with a good view of the sky.

HOW TO WATCH
You can see the Sun and an eclipse with special eclipse or solar viewing glasses. NEVER look directly at the Sun without appropriate eyewear. Regular sunglasses are not safe to view an eclipse. *https://go.nasa.gov/342otvS*

HOW LONG WILL IT LAST
A total eclipse, when the Sun is completely blocked by the Moon, will last up to a few minutes, depending on your location.


Credit: International Space Station

This photo taken from the International Space Station shows the Moon's umbral, or inner, shadow during the total solar eclipse of March 29, 2006.

SAFELY observing THE SUN

WARNING! Never look directly at the Sun without proper eye protection. You can ***seriously*** injure your eyes.

Check with local science museums, schools and astronomy clubs for eclipse glasses—or purchase an ISO 12312-2 compliant pair of these special shades! Always inspect your solar filter before use. If scratched or damaged, discard it.

View the eclipse with special eclipse glasses.

Regular sunglasses are not safe to view the eclipse.

BUILD A SOLAR VIEWER

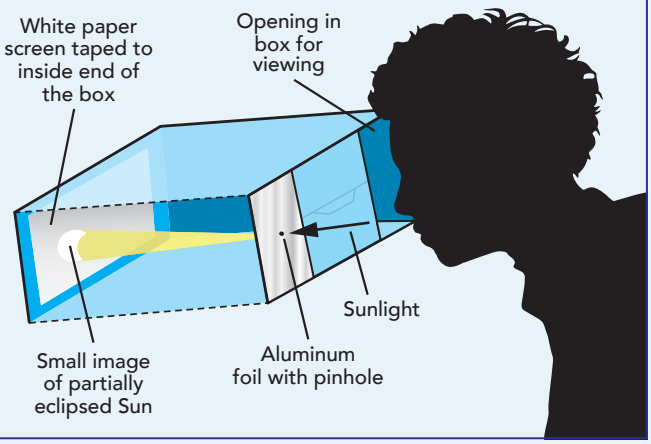
Create an inexpensive but functional, safe solar viewer with just plywood, lenses, rubber bands, paper and popsicle sticks! *https://go.nasa.gov/3yxoA0T*

MAKE YOUR OWN ECLIPSE PROJECTOR

You can make this simple eclipse projector with almost any cardboard box, paper, tape and foil.

The longer the distance from the pinhole to screen, the larger the image of the Sun will be.

NEVER look directly at the Sun without appropriate eyewear.



ECLIPSES IN THE UNITED STATES: The next solar eclipses that cross the United States are on Saturday, October 14, 2023 (Annular Solar Eclipse) and Monday, April 8, 2024 (Total Solar Eclipse).

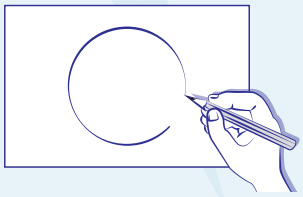
For more on eclipses: *http://www.nasa.gov/eclipse*

This product is supported by NASA under cooperative agreement number NNH15ZDA004C.

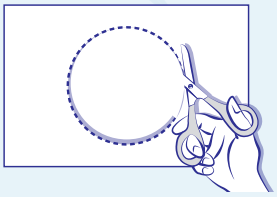
DRAW THE CORONA

Long before there were cameras or telescopes, eclipse watchers recorded what they saw in the sky in words, drawings, and paintings. You can have fun creating your own picture of a solar eclipse with chalk and paper! You can do this activity before an eclipse to predict what you'll see, or after to record what you saw.

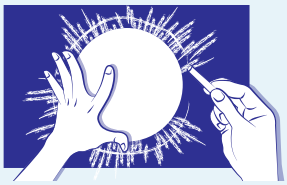
First, trace a large circle template on stiff paper.



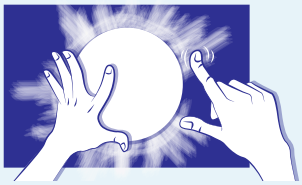
Carefully cut out the circle.



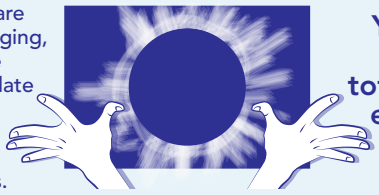
Place the template on dark paper and hold or tape it down. Draw a thick circle or lines of chalk around the template a few times — it doesn't need to be neat!



Holding the template in place, smudge the chalk away from the center of the circle using a finger to create the corona of the Sun.



When you are done smudging, remove the circle template and add words, pictures, or fun designs.



You've made total solar eclipse art!

The whole family can get involved in learning about eclipses! Morgan (age 5) and Chelsea (age 2) drew these dazzling coronas.

National Aeronautics and Space Administration

Vive la Experiencia el Eclipse Solar


Crédito: S. Habbal, M. Druckmüller y P. Aniol

¿QUÉ ES UN ECLIPSE SOLAR?

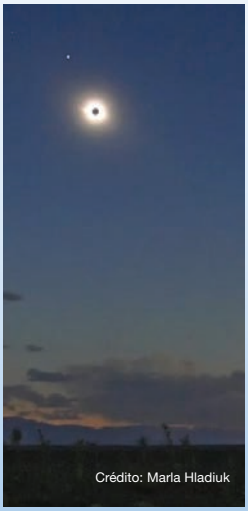
Un eclipse solar ocurre cuando la Luna pasa entre el Sol y la Tierra, y proyecta una sombra sobre la Tierra, bloqueando total o parcialmente la luz del Sol en ciertas zonas. Hay diferentes tipos de eclipses solares.

Eclipse solar total
Para que ocurra un eclipse solar total, el Sol, la Luna y la Tierra deben estar en línea recta. Quienes ven el eclipse total están en el centro de la sombra de la Luna cuando llega a la Tierra. El cielo se pondrá muy oscuro, como si fuera de noche. Si el tiempo lo permite, las personas en el recorrido de un eclipse solar total pueden ver la corona del Sol, que es su atmósfera exterior. Un eclipse solar total es el único tipo de eclipse solar que los observadores pueden mirar sin sus gafas para eclipses; y solo pueden quitárselas cuando la Luna bloquea al Sol por completo.

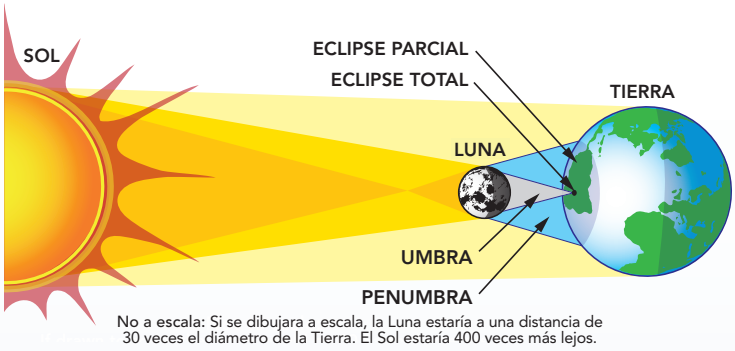
Eclipse solar anular
Un eclipse anular ocurre cuando la Luna está alineada entre el Sol y la Tierra, pero está en su punto más lejano desde la Tierra. Debido a que la Luna está más lejos de la Tierra, parece más pequeña. La Luna no bloquea la visión completa del Sol. La Luna delante del Sol se verá como un disco oscuro encima de un disco brillante más grande. Esto crea lo que parece un anillo alrededor de la Luna.

Conocido como eclipse híbrido, a veces un eclipse puede cambiar de anular a total a medida que la sombra de la Luna pasa por la superficie de la tierra.

Eclipse solar parcial
Esto sucede cuando el Sol, la Luna y la Tierra no están exactamente alineados. El Sol parecerá tener una sombra oscura solo en una parte de su superficie. Durante un eclipse solar total o anular, las personas que están fuera de la sombra interna de la Luna ven un eclipse solar parcial.


Crédito: Marla Hladiuk

ECLIPSE SOLAR TOTAL



No a escala: Si se dibujara a escala, la Luna estaría a una distancia de 30 veces el diámetro de la Tierra. El Sol estaría 400 veces más lejos.

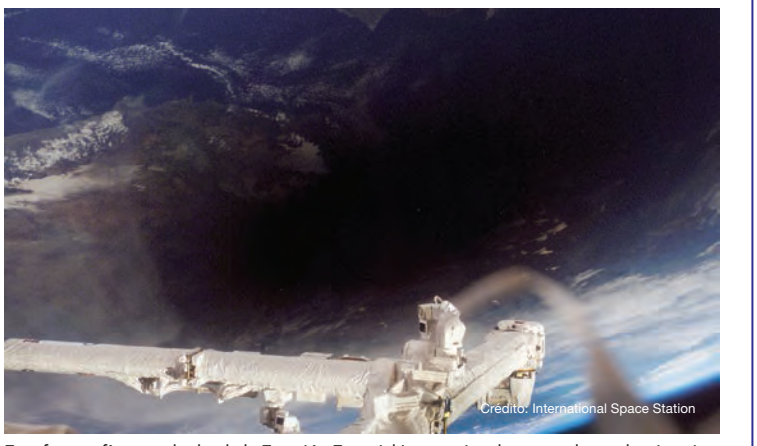

Crédito: Rick Fienberg, TravelQuest International and Wilderness Travel

En esta serie de imágenes de 2013, la secuencia del eclipse progresa de derecha a izquierda. La imagen central muestra la totalidad; en ambos lados están los anillos de diamantes del segundo (derecha) y el tercer (izquierda) contacto que marcan respectivamente el comienzo y final de la totalidad.

DÓNDE OBSERVAR
Busca un lugar agradable, descubierto y con buena visibilidad del cielo.

CÓMO OBSERVAR
Puedes mirar el Sol y el eclipse con gafas especiales para eclipses. NUNCA mires directamente al Sol sin las gafas apropiadas. No es seguro ver el eclipse con gafas de sol normales. Más: *https://go.nasa.gov/342otvS*

CUÁNTO DURARÁ
El eclipse total, que se da cuando la Luna bloquea completamente al Sol, durará hasta 2 minutos y 40 segundos, dependiendo de dónde estés.


Crédito: International Space Station

Esta fotografía tomada desde la Estación Espacial Internacional muestra la sombra interior de la Luna, llamada umbra, durante el eclipse solar total del 29 de marzo de 2006.

Observando el Sol sin Peligro

¡CUIDADO! Nunca mires directamente al Sol sin protección ocular. Te podrías lesionar ***gravemente*** los ojos.

Ponte en contacto con museos de ciencia, escuelas, y organizaciones de astronomía para obtener gafas especiales para el eclipse — o compra un par de estos lentes especiales que sea compatible con la normativa normativa ISO 12312-2.

Mira el eclipse con gafas especiales para eclipses.

Las gafas de sol comunes no son seguras para ver el eclipse.

CONSTRUYE UN VISOR SOLAR

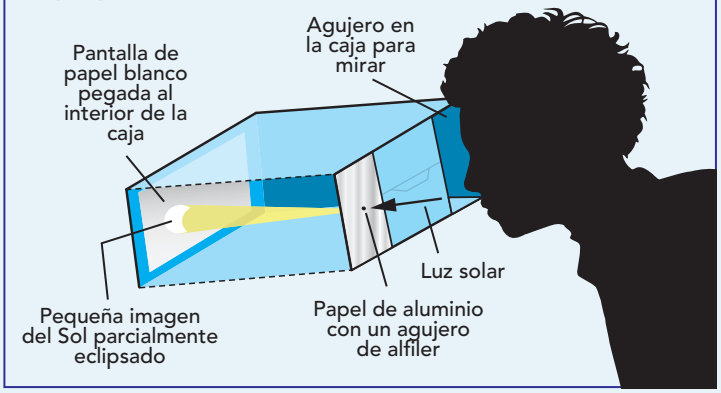
¡Crea un visor solar barato y seguro, pero funcional, usando solamente láminas de madera, lentes, bandas de goma, papel y palitos de helado! (Actividad en inglés) https://go.nasa.gov/3yxoA0T

HAZ TU PROPIO PROYECTOR DE ECLIPSE

Puedes construir este simple proyector solar con cartón, papel, cinta adhesiva, y papel de aluminio.

Cuanta más distancia haya entre el agujero y la pantalla, más grande será la imagen proyectada del Sol.

NUNCA mires directamente al Sol sin las gafas apropiadas.



ECLIPSES EN LOS ESTADOS UNIDOS: Los próximos eclipses solares en los Estados Unidos serán el sábado 14 de octubre de 2023 (eclipse solar anular) y el lunes 8 de abril de 2024 (eclipse solar total).

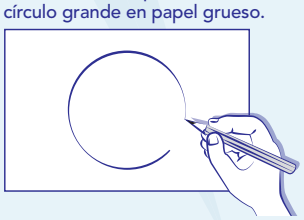
Más sobre eclipses: *http://www.nasa.gov/eclipse*

Este producto está respaldado por la NASA bajo el acuerdo cooperativo NNH15ZDA004C

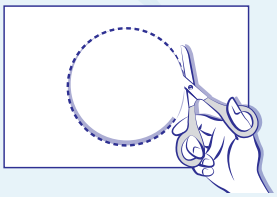
DIBUJA LA CORONA

Mucho antes de que existieran cámaras o telescopios, los observadores de eclipses registraban lo que veían en el cielo con palabras, dibujos y pinturas. ¡Tú puedes divertirte creando tu propio dibujo de un eclipse solar con tiza y papel! Puedes hacer esta actividad antes de un eclipse para predecir lo que verás, o después para registrar lo que viste.

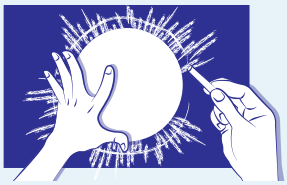
Primero, traza la plantilla de un círculo grande en papel grueso.



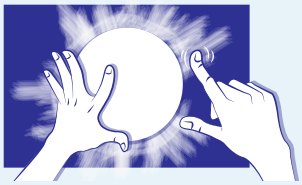
Recorta el círculo con cuidado.



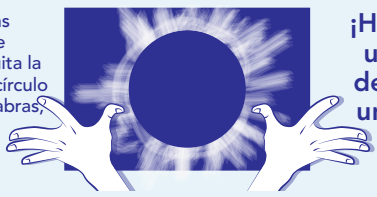
Coloca la plantilla sobre papel oscuro y mantenla fija con la mano o con cinta adhesiva. Dibuja un círculo grueso o líneas de tiza alrededor de la plantilla varias veces… ¡no tiene que quedar perfecto!



Manteniendo fija la plantilla, difumina la tiza lejos del centro del círculo con un dedo para crear la corona del Sol.



Cuando hayas terminado de difuminar, quita la plantilla del círculo y agrega palabras, dibujos o diseños divertidos.



¡Haz hecho una obra de arte de un eclipse total!

¡Toda la familia puede participar y aprender sobre los eclipses! Morgan (edad 5 años) y Chelsea (edad 2 años) dibujaron estas hermosas coronas.

Two Solar Eclipses Six Months Apart

October 14, 2023 and April 8, 2024

National Aeronautics and Space Administration

Diagrams are not to Scale:
If the Sun's diameter is scaled to 10 cm (3.9 in), Earth would be about 0.09 cm (0.04 in) and 10 meters away (33 feet).

The next **total solar eclipse** visible over the continental United States will be on **April 8, 2024**.

What is a Solar Eclipse?

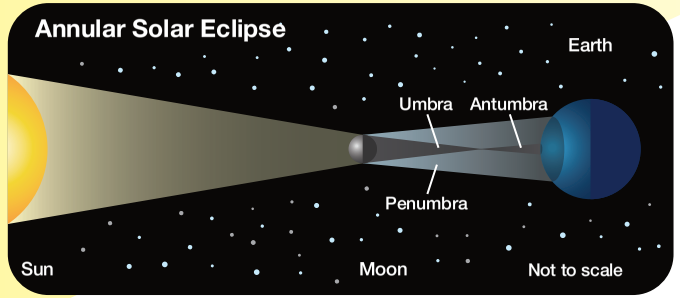
A **solar eclipse** happens when the Moon—as it orbits Earth—fully or partially blocks the light of the Sun, thus casting its shadow on Earth.

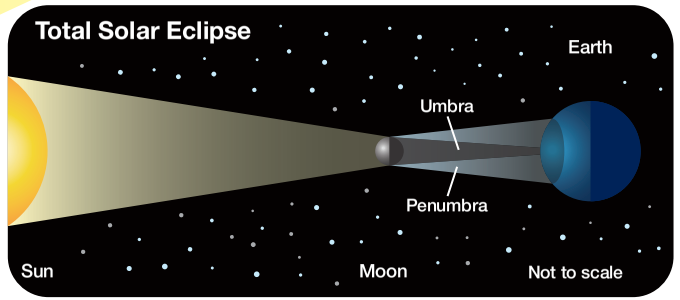
What is a Total Solar Eclipse?

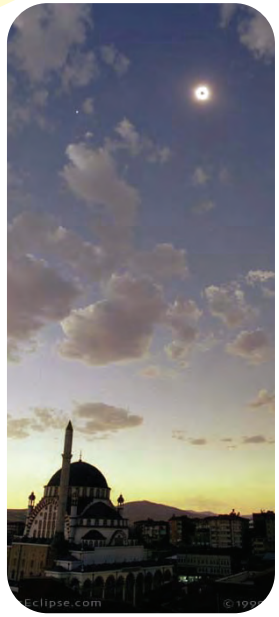
As observed from Earth, if the Moon is closer to Earth in its orbit and is aligned between Earth and Sun, it appears to be the same size as the Sun and a **total solar eclipse** occurs. The Moon blocks all the bright light from the surface of the Sun and the corona can be seen.

What is an Annular Eclipse?

As observed from Earth, an **annular eclipse** occurs when the Moon is aligned between Earth and Sun and is far enough from Earth to appear smaller than the Sun so that a ring (annulus) of sunlight remains visible around the Moon.







The predicted path of the October 14, 2023 annular eclipse and the April 8, 2024 total solar eclipse.

Duration of Greatest Eclipse for Annular:
5 min 17 sec (18:00 UT=13:00 CDT=1 p.m. CDT)

Location of Greatest Eclipse:
11 deg 22 min N; 83 deg 6 min W (Central America)

Duration of Greatest Eclipse for Total:
4 min 28 sec (18:18 UT=13:18 CDT=1:18 p.m. CDT)

Location of Greatest Eclipse:
25 deg 17 min N; 104 deg 8 min W (Mexico)

Never look directly at the Sun unless you have filters that you know are safe.

For more information: https://solarsystem.nasa.gov/eclipses/future-eclipses/eclipse-2023/
https://solarsystem.nasa.gov/eclipses/future-eclipses/eclipse-2024/
https://solarsystem.nasa.gov/eclipses/safety/
https://eclipse.aas.org/resources

Annular Eclipse
Tokyo, Japan,
May 20, 2012

Total Eclipse
Lewisville, Idaho,
August 21, 2017

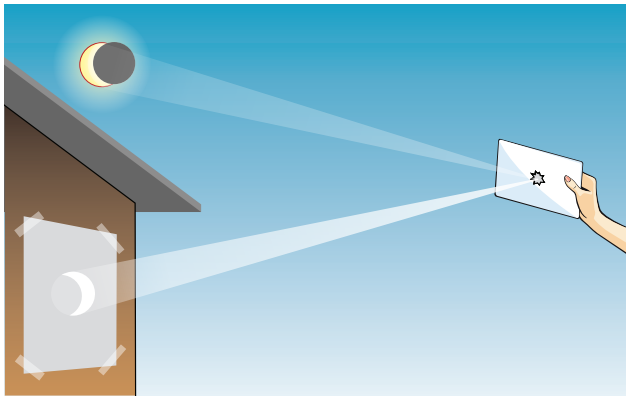
www.nasa.gov

Mitzi Adams • *mitzi.adams@nasa.gov* • **256–961–7626**

MSFC G–605996

Safely Observing the Sun

WARNING: Never look directly at the Sun without proper eye protection.
You can *seriously* injure your eyes.



For any **total** solar eclipse, if the Sun is not 100% covered in your area, please travel to an area inside the path of totality to experience a fully eclipsed Sun. **You will be disappointed if you don't!**

Mirror in an Envelope

Slide a mirror into an envelope with a ragged hole cut into the front. Point the mirror toward the Sun so that an image is reflected onto a screen at least 5 meters (about 15 feet) away. The longer the distance, the larger the image.

Do not look at the mirror, only at the screen.

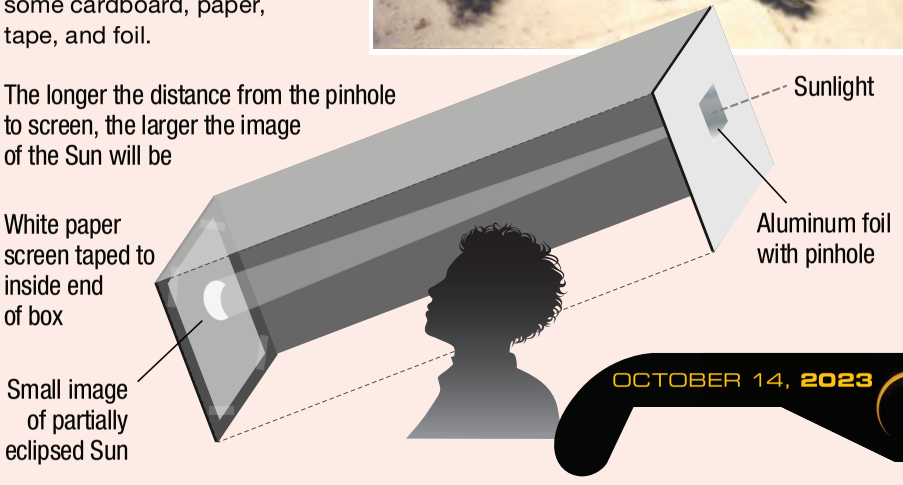
Strange Shadows!

Sunlight through trees produces projected crescents during partial phases.

Photograph (below) Copyright © Elisa J. Israel

Go Stick Your Head in a Box

You can make this simple "eclipse telescope" with some cardboard, paper, tape, and foil.



Local Area for Path of Annularity—October 14, 2023

Location	% Covered	Start (CDT)	Max (CDT)	End (CDT)
Eugene, OR	89%	10:05AM	11:18AM	12:39PM
Battle Mountain, NV	89%	10:06AM	11:23AM	12:48PM
Sevier, UT	89%	10:08AM	11:28AM	12:56PM
Monument Valley, UT/AZ	89%	10:10AM	11:31AM	1:01PM
Albuquerque, NM	90%	10:13AM	11:37AM	1:09PM
San Antonio, TX	90%	10:23AM	11:54AM	1:33PM

Local Area for Path of Totality—April 8, 2024

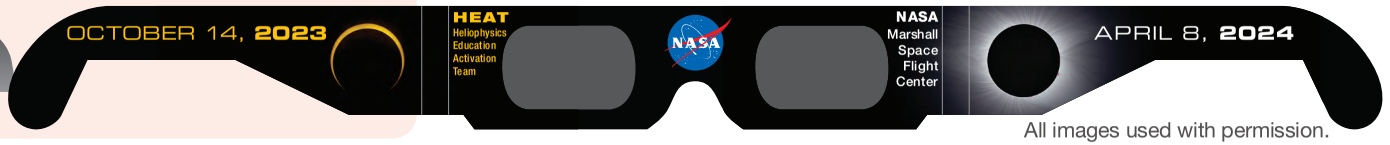
Location	% Covered	Start (CDT)	Max (CDT)	End (CDT)
Vanderpool, TX	100%	12:13PM	1:33PM	2:54PM
Monument Valley, UT/AZ	60%	12:18PM	1:28PM	2:42PM
Sulfur Springs, TX	100%	12:25PM	1:45PM	3:04PM
Shreveport, LA	98%	12:27PM	1:47PM	3:07PM
Little Rock, AR	100%	12:33PM	1:52PM	3:11PM
Memphis, TN	98%	12:37PM	1:56PM	3:15PM
Cape Girardeau, MO	100%	12:41PM	2:00PM	3:17PM
Paducah, KY	100%	12:42PM	2:01PM	3:18PM
Indianapolis, IN	100%	12:50PM	2:07PM	3:23PM
Columbus, OH	99%	12:55PM	2:12PM	3:27PM
Amherst, OH	100%	12:58PM	2:14PM	3:28PM
Buffalo, NY	100%	1:04PM	2:20PM	3:32PM
Burlington, VT	100%	1:14PM	2:27PM	3:37PM
Baxter State Park, ME	100%	1:20PM	2:32PM	3:40PM

JAVA Script Solar Eclipse Explorer
http://eclipse.gsfc.nasa.gov/JSEX/JSEX-NA.html

Sun Funnel
Make this device for your telescope with simple instructions at: https://eclipse2017.nasa.gov/make-sun-funnel

Cool in the Shades

Contact your local astronomical society to pick up a pair of eclipse glasses or visit this site for suggested resources:
https://eclipse.aas.org/resources/solar-filters



Eclipse Naturalist Observations Observer: ____________________ Date: __________ Location: ____________________

Time	Fraction of Sun covered	Temperature	Cloud cover %	Cloud type(s)	Wind speed "e" = estimated	Wind direction	Animal / bird species observed	Animal / bird behavior noted

Eclipse Naturalist Observations Observer: ______________________ Date: ____________ Location: ______________________

Time	Fraction of Sun covered	Temperature	Cloud cover %	Cloud type(s)	Wind speed "e" = estimated	Wind direction	Animal / bird species observed	Animal / bird behavior noted