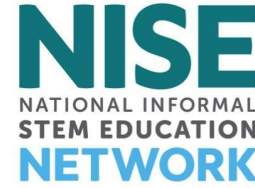


NISE Network Online Workshop

Solar Eclipse Event Planning for October 14, 2023

A Review of the Newest Resources for Engaging the Public

Tuesday, September 12, 2023



Today's Presenters:

Catherine McCarthy, NISE Network

Kristen Weaver, NASA Goddard Space Flight Center, Science Systems and Applications, Inc.

Carolyn Ng, NASA Goddard Space Flight Center, NASA Heliophysics Education Activation Team (HEAT)

MaryKay Severino, ARISA Lab LLC, Eclipse Soundscapes Project

Dennis Schatz, National Science Teaching Association (NSTA), Solar Eclipse Activities for Libraries (SEAL)

Robyn Higdon, Exploratorium, Eclipse Live Streams

Vivian White, Astronomical Society of the Pacific, Night Sky Network, Eclipse Ambassadors

Welcome! As we wait to get started with today's discussion, please:

Introduce yourself! Type your name, institution, and location into the [Chat Box](#)

Questions? Feel free to type your questions into the [Chat Box](#) at any time throughout the webinar or use the raise your hand function in the participants list and we'll unmute your microphone.

Today's discussion will be recorded and shared on nisenet.org at: nisenet.org/events/online-workshop

Two Upcoming Solar Eclipses!

**Saturday
October 14 2023**

Annular



Credit: NASA/Bill Dunford

**Monday
April 8 2024**

Total



Credit: NASA/MSFC/Joseph Matus

**North American locations not on
the path will still experience a
partial solar eclipse!**

Partial



Credit: NASA/Bill Ingalls

ANNULAR SOLAR ECLIPSE OVER THE UNITED STATES



DURATION OF ANNULAR SOLAR ECLIPSE AND MAXIMUM PARTIAL ECLIPSE OCTOBER 14, 2023



The eclipse figures outside the path of annular solar eclipse depict the maximum partial solar eclipse. Values such as ".80" indicate that at maximum partial eclipse, the brightness of sunshine is diminished by 80%.



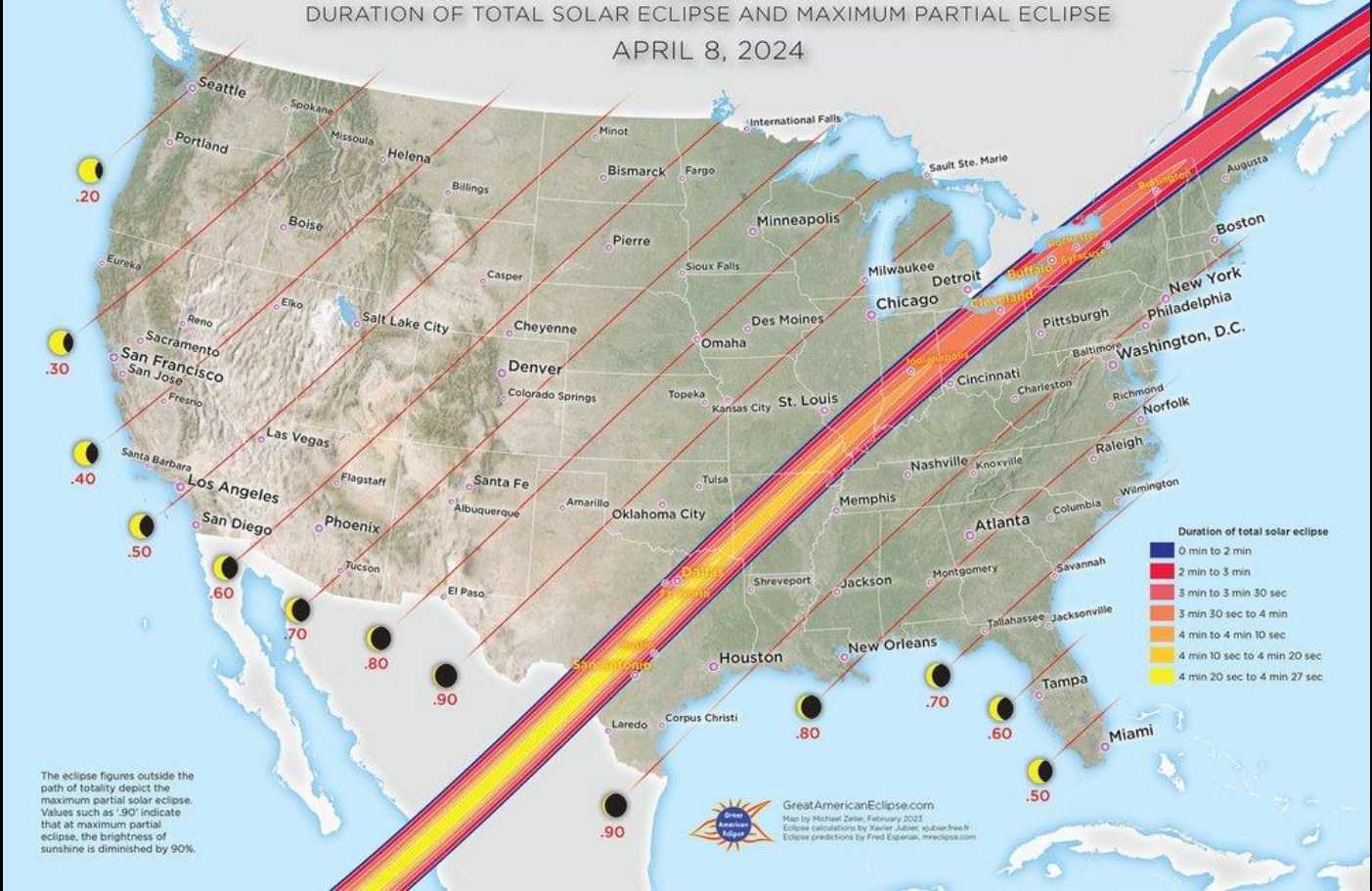
GreatAmericanEclipse.com
Map by Michael Zeiler, February 2023
Eclipse calculations by Xavier Jubier, xjubier.free.fr
Eclipse predictions by Fred Espenak, timeclipse.com

Credit:
Michael Zeiler
GreatAmericanEclipse.com

TOTAL SOLAR ECLIPSE OVER THE UNITED STATES



DURATION OF TOTAL SOLAR ECLIPSE AND MAXIMUM PARTIAL ECLIPSE APRIL 8, 2024



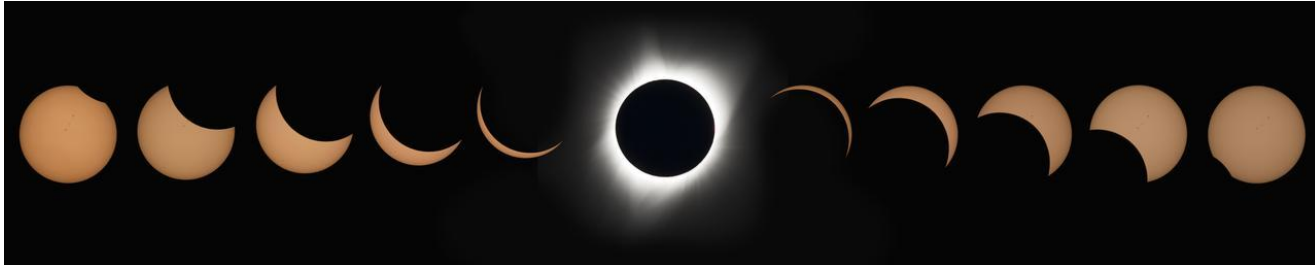
The eclipse figures outside the path of totality depict the maximum partial solar eclipse. Values such as ".90" indicate that at maximum partial eclipse, the brightness of sunshine is diminished by 90%.



GreatAmericanEclipse.com
Map by Michael Zeiler, February 2023
Eclipse calculations by Xavier Jubier, xjubier.free.fr
Eclipse predictions by Fred Espenak, mneclipse.com

Credit:
Michael Zeiler
GreatAmericanEclipse.com

NISE Network Solar Eclipse Resources



Compilation of Eclipse public engagement resources:

- Hands-on activities
- Maps and images
- Safe viewing
- Cultural connections and more!



nisenet.org/solareclipse

NISE Network Solar Eclipse Activities

Exploring the
Solar System:
**Big Sun,
Small Moon**



Exploring the
Solar System:
Solar Eclipse



Exploring
Earth:
Bear's Shadow



Exploring the
Solar System:
**Observe the
Sun**



Apps with Hands-on Activities

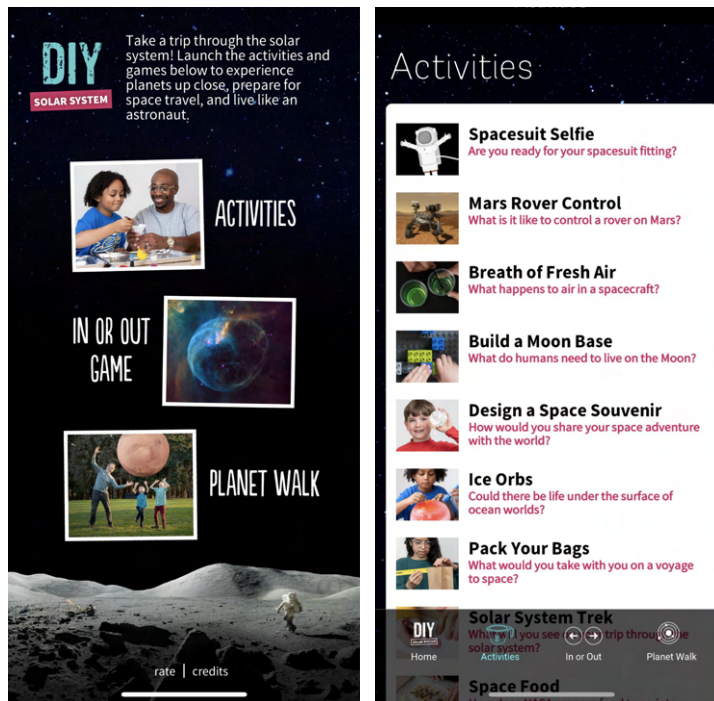
DIY Sun Science

English & Spanish

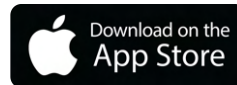


DIY Solar System

English (Spanish coming soon)



Both available
for **iPhones**
& **iPads**



DIY Sun Science
available for
Android

DIY Solar
System for
Android

Coming Soon!

nisenet.org/diy-solar-system-app

nisenet.org/diy-sun-science-app

NEW - Preparing for a Solar Eclipse Presentation

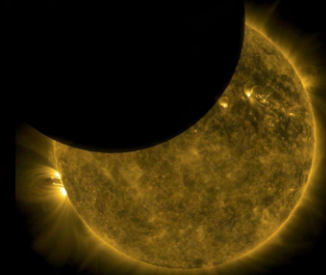
Preparing for a Solar Eclipse



Credit: NASA Goddard

Presentation Overview

- What are solar eclipses
- How to enjoy a solar eclipse safely
- Solar eclipse resources for everyone



SDO/AIA 171 2010-10-07 11:58:35 UT

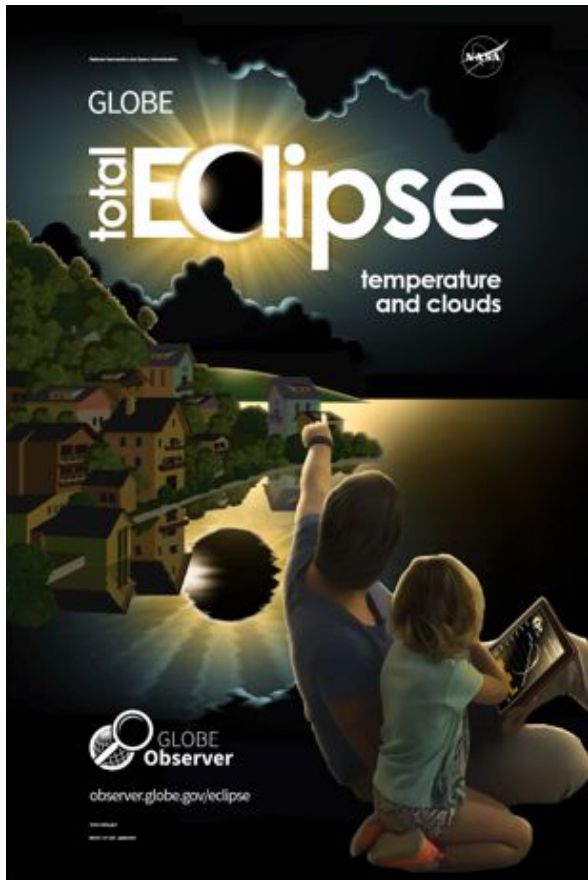
Credit: NASA Goddard

Everyone Can Participate in a Solar Eclipse!



Credits: Science Museum of Minnesota and Emily Maletz for NISE Network

nisenet.org/solareclipseslides



GLOBE Eclipse poster, available in the [Resource Library](#).

GLOBE Eclipse: Preparing for 2023 & 2024

Kristen Weaver
Deputy Coordinator, GLOBE Observer

NASA's Goddard Space Flight Center &
Science Systems and Applications, Inc



The Earth Science Angle: Study eclipses as a volunteer observer with GLOBE

The Sun drives many processes in Earth's atmosphere.

National Aeronautics and Space Administration

Air Temperature
Energy from the Sun warms the surface of the Earth. Warmth from the Earth's surface heats the surrounding air, causing it to rise.

Clouds
Warm air cools as it rises, and water vapor condenses into puffy cumulus clouds.

Wind
Changes in temperature drive differences in air pressure, causing wind to form.

How will the eclipse affect these solar-powered processes?

Share your eclipse observations using the GLOBE Observer app.
Learn more at observer.globe.gov/eclipse

GLOBE Observer
the app of THE GLOBE PROGRAM

nasa.gov

The infographic features a top section with a yellow banner and the NASA logo. Below this is a row of six sun icons showing a progression from a full sun to a total eclipse. The middle section has three colored boxes (yellow, green, blue) describing air temperature, clouds, and wind. The bottom section shows a landscape with a sun, clouds, and a large yellow arrow pointing up from the ground to the sun, and a blue arrow pointing down from the sun to the ground, illustrating the cycle of solar energy. A QR code is located in the bottom right corner.

Energy from the Sun warms our planet, and changes in sunlight can also cause changes in temperature, clouds, and wind. What happens when the Sun is blocked by the Moon during an eclipse? How will the eclipse affect these solar-powered processes?

Diagram from the front side of a one-page document outlining the changes that might be observed during a solar eclipse, which is available on the [GLOBE Observer Eclipse website](https://observer.globe.gov/eclipse).

Using the GLOBE Eclipse tool, volunteer scientists are able to:

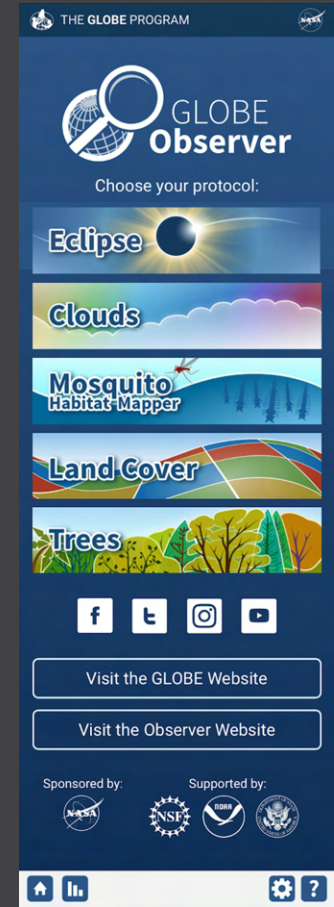
- Observe how the eclipse changes atmospheric conditions near you by reporting on clouds and air temperature



Taking clouds observations using the Clouds tool is always available in the GLOBE Observer app, and is incorporated into the observation prompts for the Eclipse tool. Credit: GLOBE Clouds Team, NASA LaRC



Above: A simple thermometer that can be used to take air temperature measurements. Credit: GLOBE Right: An example of what the home screen of the GLOBE Observer app will look like when the Eclipse tool is available. Credits: GLOBE



- Report surface conditions (photograph and describe the landscape) that may have an impact on differences in the atmospheric effects in varying locations

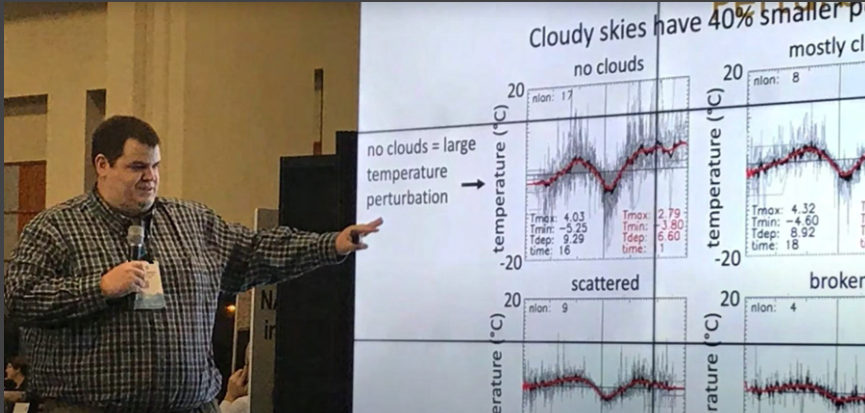


A participant using the GLOBE Observer app Land Cover tool to take photos of the surrounding landscape. Credit: GLOBE



A screenshot from the GLOBE Visualization System, <https://vis.globe.gov>, showing images of land cover taken around the United States. Credit: GLOBE

- Contribute to a citizen science database used by scientists and students to study the effects of eclipses on the atmosphere



Left: Dr. Brant Dodson (NASA Langley Research Center) presents his paper comparing the citizen science temperature data at different reported levels of cloud cover, doi.org/10.1175/JAMC-D-18-0297.1

Right: Pages from several of the research reports submitted by students to the GLOBE International Virtual Science Symposia after the 2017, 2019 and 2020 eclipses, observer.globe.gov/eclipses#studentresearch

2020 GLOBE International Virtual Science Symposium
EPPI Nº1345 – PUJATO GLOBE Santa Fe – ARGENTINA

23

| Fecha | Horario | Categorías | | | | Total de palomas en cada grupo |
|--------------------|---------|------------|--------|---------|---------|--------------------------------|
| | | Comen | Vuelan | Duermen | Vigilan | |
| 1 de julio de 2019 | 17:30 | 1 | 3 | 2 | 6 | |
| | 17:35 | 3 | 4 | 1 | 8 | |
| | 17:40 | 1 | 2 | 4 | 2 | 9 |
| Totales | 17:45 | 1 | 9 | 15 | 6 | 38 |

Figura 33: Etograma de la observación del día 01/07/2019 de 17:30 a 17:45 horas realizado con Excel (2016)

A su vez, en la Figura 34 puede observarse el gráfico por categorías correspondientes al etograma de la Figura 33, que también se encuentra en el Anexo 1.

Gráfico correspondiente a la observación de las palomas el 01-07-2019, el intervalo horario 17:30 - 17:45

| Horario | Comen | Vuelan | Duermen | Vigilan |
|---------|-------|--------|---------|---------|
| 17:30 | 1 | 3 | 2 | 6 |
| 17:35 | 3 | 4 | 1 | 8 |
| 17:40 | 1 | 2 | 4 | 2 |

Figura 34: Gráfico correspondiente al Etograma de la observación de las palomas el 01-07-2019, el intervalo horario 17:30 a 17:45 horas elaborado con Excel (2016)

Todos los etogramas y pictogramas (diagramas de barras) que se encuentran en la carpeta de campo de la investigación y en los anexos correspondientes a las tablas y gráficos correspondientes a cada observación, los cuales fueron tenidos en cuenta al realizar este informe solo se muestran estos ejemplos y se adjuntan en Excel (2016).

Las tablas y gráficos realizados permitieron analizar los primeros resultados de la investigación.

| Air Temperature (°C) | Surface Temperature (°C) |
|----------------------|--------------------------|
| 7 | 7.8 |
| 7 | 8.7 |
| 9 | 11.2 |
| 11 | 10.2 |
| 9 | 8.8 |
| 6 | 7.6 |
| 6 | 6.8 |
| 5 | 6.6 |
| 6 | 5.4 |
| 6 | 6.2 |
| 9 | 5.4 |
| 9 | 7.9 |
| 11 | 4.8 |
| 8 | 10.4 |
| 11 | 11.8 |
| 6 | 10.6 |
| 8 | 7.4 |
| 11 | 8 |
| 11 | 5.1 |
| 14 | 5.8 |

Air Temperature VS. Surface Temperature

Colegio Fausta Villa Eucarística
Formando jóvenes con ideales

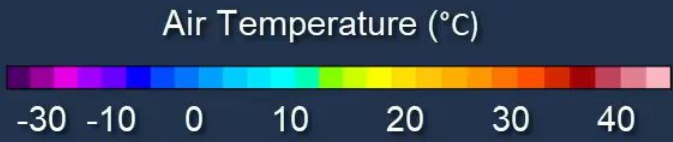
Educative Fausta

Datos cargados a la plataforma de GLOBE Observer.
Nuestra ubicación se encuentra señalada con un círculo rojo:

GLOBE Visualization System

- Provide comparison data even if not on the path of maximum eclipse

Eclipse shadow location is an estimation.



August 21, 2017 Eclipse
Air Temperature Measurements



Eye Safety During an Annular Eclipse

The Sun is never completely blocked by the Moon during an annular solar eclipse. Therefore, during an annular eclipse, it is never safe to look directly at the Sun without specialized eye protection designed for solar viewing.



A solar eclipse watcher in Argentina in December 2020.
Credit: Marta Kingsland



A crowd uses handheld solar viewers and solar eclipse glasses to safely view a solar eclipse. Credit: National Park Service



View the eclipse with special solar viewing glasses

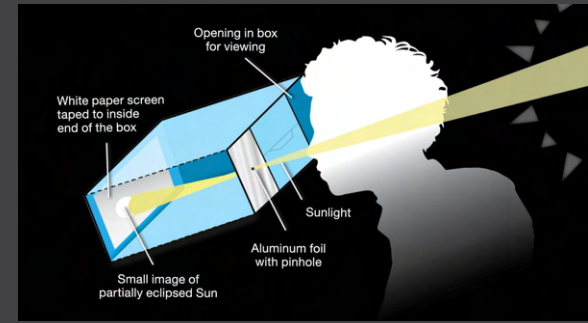


Regular sunglasses are not safe to view the eclipse

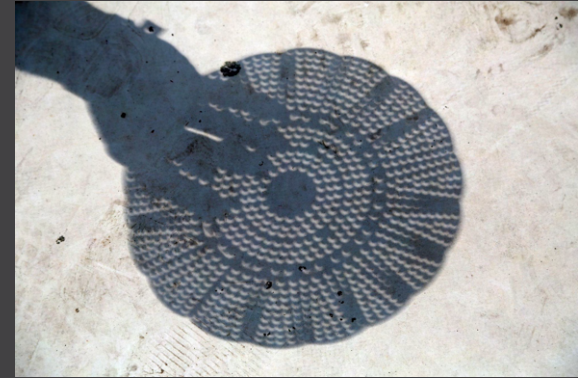
Indirect viewing methods

If you don't have eclipse glasses or a handheld solar viewer, you can use an indirect viewing method, which does not involve looking directly at the Sun. For example, a pinhole projector or a colander or other object with circular holes. The GLOBE Eclipse cards also have a place where a hole can be punched to serve as an indirect viewer.

Read more on [NASA's Eclipse Safety page](#).

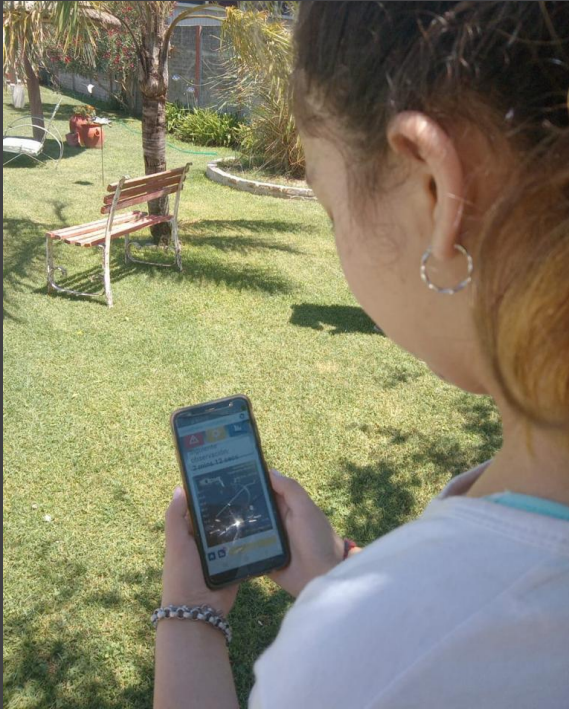


You can make your own eclipse projector using a cardboard box, a white sheet of paper, tape, scissors, and aluminum foil. Credit: NASA

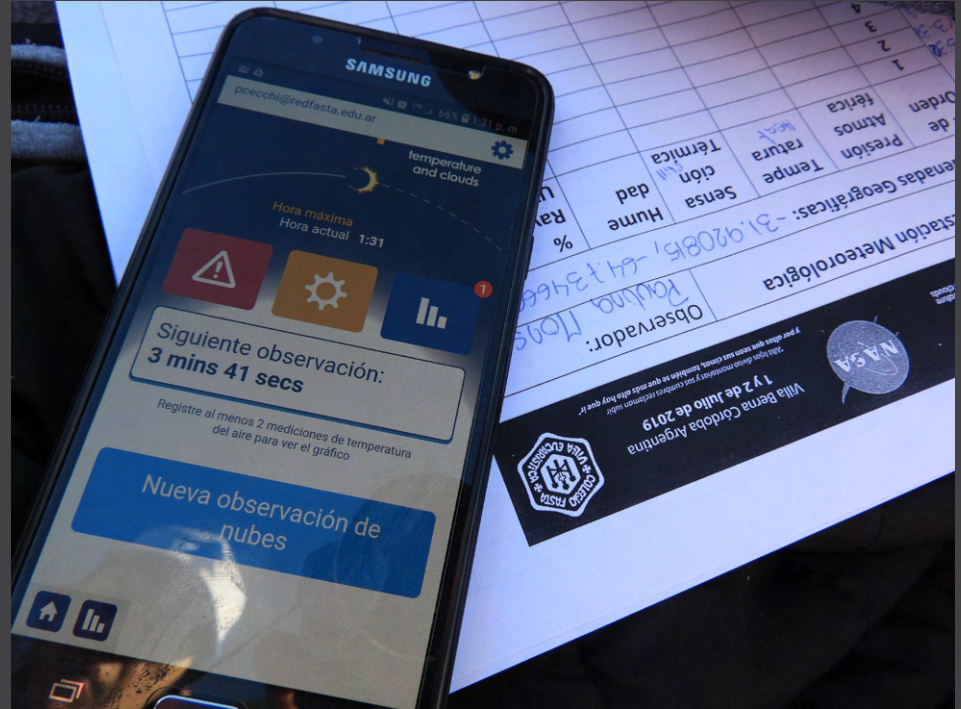


Left: A GLOBE Eclipse card used to project the Sun onto the ground. Credit: GLOBE Above: The circular holes of a colander project crescent shapes onto the ground during the partial phases of a solar eclipse. Credit: Joy Ng

Using the GLOBE Eclipse tool



Observer using the GLOBE Eclipse tool during the total eclipse in Argentina on 14 Dec 2020. Credit: Marta Kingsland



The app screen showing the countdown to the next observation, as well as an (optional) paper data sheet. Credit: Pablo Cecchi

Using the App

Settings ✕

Please confirm your thermometer type:

Type of Thermometer: ▼

C **F**

Measurement Alarm: On

Location:
-39.8546, -71.0599

Do a Land Cover observation to characterize your location (include your thermometer in the down photo!)

Land Cover

GLOBE

total ECclipse

temperature and clouds

Time of Max: 1:06
Current Time: 12:49

⚠ ⚙ 📊 1

Next Observation:
9 mins 18 secs

GLOBE August 21, 2017
Air Temperatures (F)
35.1235, -83.6373

96.3°
89.7°
83.1°
76.5°
69.9°
63.3°

1:40 2:45 3:50

observer.globe.gov

Share Graph

New Cloud Observation

🏠 📊 3



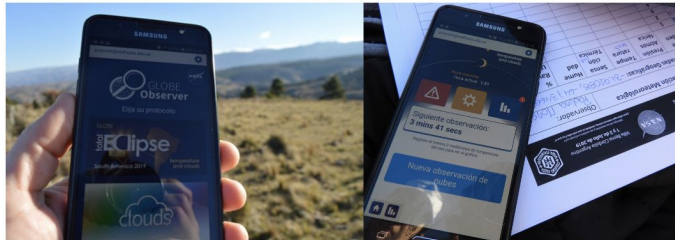
Example thermometers. Credit: GLOBE NOTE: A weather app does not count as “other” - you should have a separate physical thermometer.

Clouds

Would you like to perform a clouds observation now?

NO **YES**

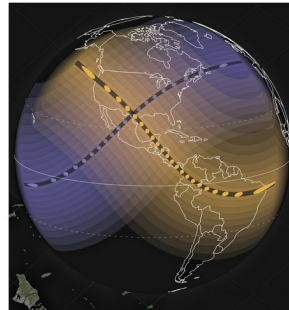
What is GLOBE Eclipse?



GLOBE Eclipse is a temporary tool in the GO app that will help you document air temperature and clouds during an eclipse. The tool is not visible in the app on a regular basis, but is only opened up when a solar eclipse is happening somewhere in the world. The Eclipse tool will prompt you to take air temperature measurements using a meteorological thermometer, as well as taking regular observations of sky conditions using the [Clouds](#) tool. For more details about equipment needed, how to take observations, and frequently asked questions, visit the [Taking Observations](#) page. Our [Resource Library](#) includes additional activities, references and videos.

Image source: GLOBE School Colegio Fausta Villa Eucaristica in Argentina, taken during the July 2019 eclipse.

On 14 October 2023, an annular eclipse ☾ will take place in North, Central and South America. The path of maximum eclipse will be across parts of the United States, Mexico, Belize, Honduras, Nicaragua, Costa Rica, Panama, Columbia and Brazil (the path from upper left to lower with yellow circles in the diagram below). A partial annular eclipse will be visible in Canada, and other parts of Central and South America. This map of the 2023 eclipse ☾ shows the percentage of obscuration for any location.



Learn More
Find more details, including activity guides and extended opportunities for data collection, on the Eclipse page of the GLOBE Observer website, observer.globe.gov/eclipse

Eclipse Resource Library

Salta a recursos en español



Annular Eclipse Fact Sheet - 14 October 2023

On 14 October, 2023, an annular solar eclipse will cross North, Central, and South America. Visible in parts of the United States, Mexico, and many countries in South and Central America, millions of people in the Western Hemisphere can experience this eclipse. This fact sheet, available to download in color and grayscale, provides information about eclipses and how to watch this one safely.

PDF File - English

Archivo PDF - Español



Exploring the Solar System: Solar Eclipse

"Exploring the Solar System: Solar Eclipse" is a hands-on activity demonstrating how the particular alignment of the Sun, Earth, and Moon can cause an eclipse. Visitors investigate the positions of these objects to create shadows and learn about solar eclipses. This activity was designed specifically in advance of the total solar eclipse that will traverse the continental United States in August, 2017, but can be used anytime. Las actividades también están disponibles en español.



GLOBE Eclipse Pinhole Postcard

Dual-language (English and Spanish) postcard about observing the eclipse with GLOBE Observer, with a space in the middle that can be punched out to use as a pinhole projector. The text reads: "Energy from the Sun warms our planet, and changes in temperature lead to the formation of clouds and wind. What happens when the Sun is blocked by the Moon? Download the GLOBE Observer app to share your observations during the eclipse. Never look directly at the Sun! Project the eclipse onto a nearby surface using the hole in this card."

Additional Resources

The Eclipse Resource Library has a number of useful resources aimed at individual observers, and we will add more as they are developed.

También hay una sección de recursos en español.

GLOBE Eclipse

Citizen scientists contributed over 80,000 air temperature measurements and nearly 20,000 clouds observations during the 2017 solar eclipse across North America, as well as hundreds of additional observations during the 2019 and 2020 eclipses in South America. The Eclipse tool will next be active in the GLOBE Observer app for the annular eclipse in October 2023. In the meantime, you can analyze eclipse data with your participants or start preparing for an upcoming solar eclipse.

Analyze Eclipse Data

Did your museum or library host a big event for the 2017 eclipse? Invite your participants back to take a look at the observations collected by citizen scientists. [Learn more about accessing and analyzing eclipse data.](#)

Upcoming Eclipses

14 October 2023 - Annular Eclipse across North, Central and South America

8 April 2024 - Total Solar Eclipse across North America

For more information about how to take observations, visit the [GLOBE Eclipse landing page](#).

Eclipse Facilitator Resources

For more resources geared toward individual observers, visit the [Eclipse Resource Library](#) (including [recursos sobre eclipses en español](#)).



GLOBE Eclipse Presentation: Introduction, Safety & App Basics

A presentation giving an introduction to GLOBE Eclipse: the Earth science angle on eclipses and why to study them with citizen science observations, eclipse viewing safety tips, how to use the GLOBE Eclipse tool in the app, and some supplemental observing tips.

[PDF file \(1.4 MB\)](#)

[PPTX file with embedded videos \(42 MB\)](#)

[Google Slides deck \(will require making a copy\)](#)



[Learn more about the upcoming annular eclipse on the NASA Eclipse page.](#)

Lead a Program

The Eclipse Toolkit for Informal Educators has resources specifically for facilitators, and more are coming.



Download the app from the Apple App Store or Google Play.



Get the latest information as the eclipses approach by following us on social media:

- [facebook.com/TheGLOBEProgram](https://www.facebook.com/TheGLOBEProgram)
- twitter.com/GLOBEProgram
- [instagram.com/globeprogram](https://www.instagram.com/globeprogram)

[Contact the GLOBE Observer team](#) with any questions.



Eclipses

Through the Eyes of NASA

Dr. Michael Kirk, NASA HEAT's Principal Investigator
Carolyn Ng, Informal Education Specialist



Plans for 2023

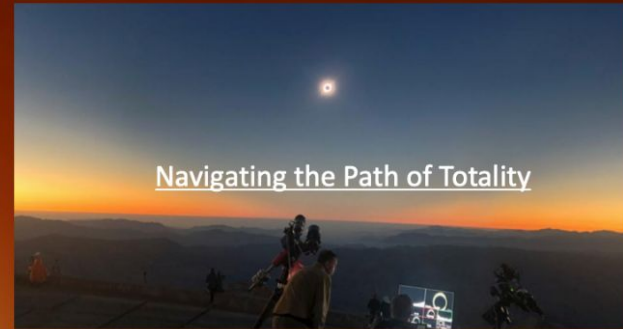
Albuquerque, NM: NASA tent at the Balloon Fiesta grounds
NASA agency broadcast
NOAA inter-agency eclipse event
NASA Helio SME engagement support

Continuing to produce eclipse and helio lessons and activities for learners of all ages.

Plans for 2024

Texas (most likely): Support for Sunspots
NASA Agency Broadcast support
NASA SME engagement Support

Even more helio lessons and activities for learners of all ages!



Eclipse-Focused NASA Science Activation Projects

<https://science.nasa.gov/learners/science-activation-teams>

A total solar eclipse is shown against a dark background. The sun is partially obscured by the moon, creating a bright ring of light around the moon's edge. The sun's rays are visible as a bright orange and yellow glow. The moon's surface is dark and shows some craters and maria.

NASA Priorities for 2024 Total Solar Eclipse

- Safety
- Broadening Participation
- Science
- Public Engagement
- Science Activation
- Citizen Science

Safe Direct Viewing



A huge group of sunspots, about the size of Jupiter, appeared on the Sun during a partial solar eclipse over Santa Cruz, California on October 25, 2014. *Credit: Astronomy Picture of the Day, [Michael Bolte \(UCSC\)](#)*

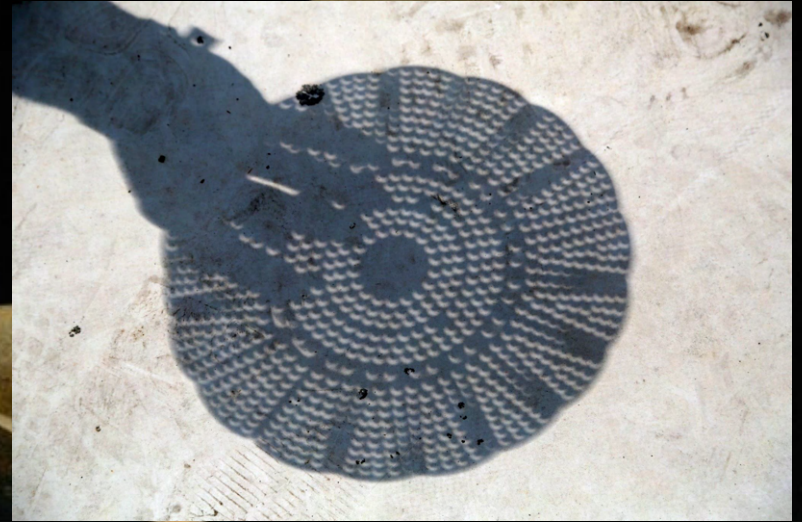


This glass accessory activity is in our database!

Safe Indirect Viewing



Build a box pinhole projector
Credit: NASA



Allow light to filter through a colander to project many partial solar eclipse images on the ground. Credit: NASA/Joy Ng

Safe Indirect Viewing



Credit: JAXA/NASA/SAO/NAOJ



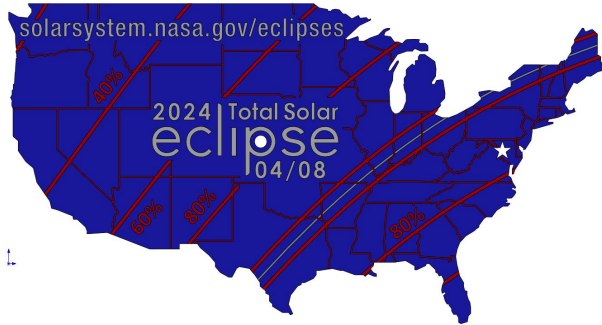
Your back should always be to the Sun when using a pinhole projector. Do NOT look at the Sun through the pinhole!



Figure 2. A 2D paper cut US map for the Saturday, October 14, 2023, annular solar eclipse. Not to scale. See Learner Handout. Credit: NASA HEAT/J. Patrick Haas



<https://nasa3d.arc.nasa.gov/detail/usa-eclipse-2023>



<https://nasa3d.arc.nasa.gov/detail/usa-eclipse-2024>

My NASA Data: Interactive Lessons



my NASA
data

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[Cryosphere](#)

[Geosphere](#)

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Solar Eclipse

A solar eclipse occurs when the Moon passes between Earth and the Sun, thereby obscuring Earth's view of the Sun, totally or partially. Such an alignment coincides with a new moon, indicating the Moon is closest to the plane of the Earth's orbit. In a total eclipse, the disk of the Sun is fully obscured by the Moon. In partial and annular eclipses, only part of the Sun is obscured.

[>> Read More >>](#)

[Mini Lessons](#)

[Interactives](#)

[Lesson Plans](#)



Map, Flyers, and Posters



Experience the Annular Solar Eclipse
Saturday, October 14, 2023

WHAT IS A SOLAR ECLIPSE?

When the Moon passes between Earth and the Sun, it blocks out all or part of the Sun. This is called a solar eclipse. A total solar eclipse occurs when the Moon's apparent size is larger than the Sun's, blocking all of the Sun's light and making the Sun's corona visible. An annular solar eclipse occurs when the Moon's apparent size is smaller than the Sun's, blocking most of the Sun's light and making the Sun's corona visible as a ring of fire.

HOW TO WATCH:

1. Find the path of the eclipse on the map.
2. Find the time of the eclipse on the map.
3. Find the time of the eclipse on the map.

HOW TO WATCH:

Use the map to find the path of the eclipse and the time of the eclipse. The map shows the path of the eclipse and the time of the eclipse. The map shows the path of the eclipse and the time of the eclipse.



Visit Hundreds of City County State and National Parks & Public Land

Experience the Great Western
RING OF FIRE ECLIPSE
from
America's Scenic Wonderland

Websites



SOLAR SYSTEM EXPLORATION
Our Galactic Neighborhood

Solar System Planets Moons Asteroids, Comets & Meteors MORE

Eclipses

NASA studies solar eclipses on the ground, in our atmosphere, and in space, influencing solar and Earth science.

U.S. ANNULAR SOLAR ECLIPSE (10/14/2023)
00:06:22:22:46:50

U.S. TOTAL SOLAR ECLIPSE (04/08/2024)
01:00:18:00:28:50

ECLIPSES HOME SAFETY FUTURE ECLIPSES SCIENCE NEWS RESOURCES ABOUT



<https://solarsystem.nasa.gov/eclipses/home/>

SOLAR SYSTEM EXPLORATION
Our Galactic Neighborhood

Solar System Planets Moons Asteroids, Comets & Meteors MORE

NASA HEAT

Welcome to your launchpad for infusing curated heliophysics resources into your learning space! NASA data, videos, activities, lesson plans, and more plus educator background on the heliophysics topics that NASA explores.

HOME ALL RESOURCES BIG IDEAS TOPICS MISSIONS ABOUT



<https://solarsystem.nasa.gov/heat/home/>

Heliophysics Missions

Exploring our Sun and its interactions with Earth is possible through innovative NASA missions.

Heliophysics Mission Fleet

Heliophysics missions are strategically placed throughout our solar system, working together to provide a holistic view of our Sun and space weather, along with their impacts on Earth, the other planets, and space in general.

NASA's heliophysics mission fleet includes 19 operating missions using 26 spacecraft, 13 missions in development, a robust sounding rocket program, and a variety of CubeSat missions.

- ESA = European Space Agency
- JAXA = Japan Aerospace Exploration Agency

● UNDER DEVELOPMENT

AWE (ISS)
Carruthers Geocorona Observatory
ESCAPEDE (2)
EUVST (JAXA)
EZIE (3)
GDC (6)

HelioSwarm (9)
HERMES (Gateway)
IMAP
MUSE
PUNCH (4)
SunRISE (6)
TRACERS (2)

● PRIMARY OPERATION

Parker Solar Probe
Solar Orbiter (ESA)

● EXTENDED OPERATION

ACE
AIM
GOLD (SES-14)
Hinode (JAXA)
IBEX
ICON
IRIS
MMS (4)
PUNCH (4)
STEREO
THEMIS-ARTEMIS (2)
THEMIS (3)
TIMED
Wind
Voyager (2)



NASA Heliophysics Big Year

The Sun will have a very Big Year from **Oct 2023 – Dec 2024!**



We want you to **bring your joy and curiosity to this opportunity of a lifetime** to participate with NASA Heliophysics! Learn more at go.nasa.gov/HelioBigYear

MONTHLY THEMES

October 2023: Annular Eclipse

November 2023: Citizen Science

December 2023: Mission Fleet

January 2024: The Sun Touches
Everything

February 2024: Fashion

March 2024: Experiencing the Sun

April 2024: Total Solar Eclipse

May 2024: Visual Art

June 2024: Performance Art

July 2024: Physical Health

August 2024: Kids

September 2024: Environment/
Sustainability

October 2024: Solar Cycle/Solar Max

November 2024: Bonus Science

December 2024: Parker's Perihelion

Resources



Public Annular Eclipse training slides:

<https://solarsystem.nasa.gov/resources/2968/annular-solar-eclipse-training/?category=heat>

Sign up for the eclipse newsletter:

go.nasa.gov/3oObEDI

My NASA Data / HEAT Formal Education Resources:

<https://mynasadata.larc.nasa.gov/phenomenon/solar-eclipse>

HEAT-developed Eclipse Resources (continually updated with new materials; e.g., helio-club for out of school time):

https://solarsystem.nasa.gov/heat/all-resources/?order=pub_date+desc&per_page=50&page=0&search=Eclipse&filter_categories%5B0%5D%5B%5D=469&fs=&fc=&ft=&dp=&category=469

Eclipse Website for all updates (resources, events, announcements, etc.): <https://solarsystem.nasa.gov/eclipses/home/>



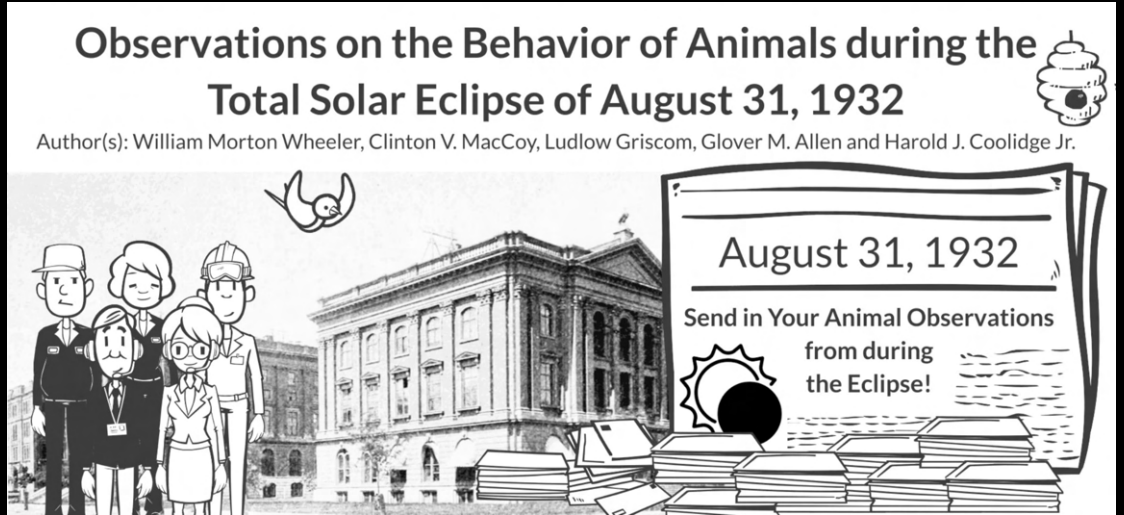
Science Question:

How does life on Earth, specifically wildlife, respond to solar eclipses?

Recreating a Study from ~ 100 years ago!



Map Courtesy of: GreatAmericanEclipse.com



MaryKay Severino

EclipseSoundscapes.org



@EclipseSoundscapes



@EclipseSoundUDL



Partner

Eclipse Soundscapes is supported by NASA award No. 80NSSC21M0008



Previous Studies Demonstrate that Solar Eclipses are Multi Sensory Events



Watch the Moon slowly creep in front of the Sun until it blocks the Sun from view.



Listen to animals, insects and people change their behavior as day suddenly becomes night.



Feel the temperature change as the Sun's warm rays are briefly blocked from reaching the Earth.



ECLIPSE

SOUNDSCAPES.ORG

Invites you to:

Work Alongside
Subject
Matter Experts



Learn about
Solar
Eclipses



Collect
Sound
Data



Submit
Observations



Analyze
Sound Data



Focuses on inclusion:

Accessibility



Universal Design for Learning

Information shared in multiple formats:



Revisits previous eclipse studies:



"Observations
on the Behavior
of Animals during
the Total Solar Eclipse
of August 31, 1932"
Wheeler et al., 1935



2017 NPS eclipse
recordings & "Listening
to the Eclipse,"
produced by
Dr. Megan McKenna
of NPS



Partner

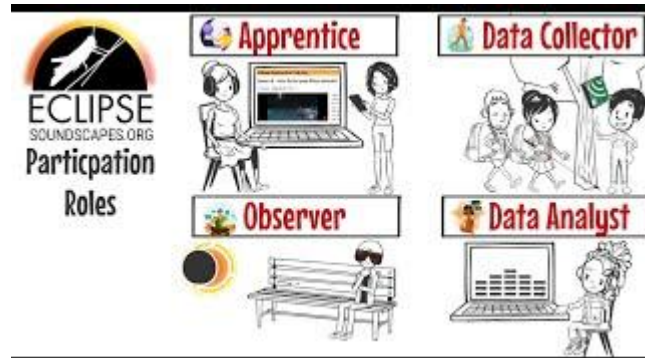


Eclipse Soundscapes: Citizen Science Project is supported by NASA award No. 80NSSC21M0008



How to Participate?

Collect & analyze observations and sound data from the October 14, 2023, annular eclipse and the April 8, 2024, total solar eclipse to help us understand the impact of solar eclipses on various U.S. ecosystems.



FREE

Online



APPRENTICE (Online Eclipse Learning)

Learn about solar eclipses via free online learning and earn a certificate of completion.

FREE

ANY
Location



OBSERVER (Eclipse Day Activity)

During the 2023 annular eclipse or the 2024 total eclipse path, go outside and observe with all of the senses available to you. Then share these observations with the ES team via the ES website!

**Equipment
Required**

70%+
Eclipse
Path



DATA COLLECTOR (Eclipse Week Activity)

Collect data using an AudioMoth Recorder along or near (70%+) the 2023 annular eclipse path or the 2024 total eclipse path. Then share the data with the ES team by mailing the MicroSD card!

FREE

Online



DATA ANALYST (Online Data Activity)

Analyze sound data in 2024 and 2025 alongside scientists on the ES website. (**Coming 2024**)



Partner

ES Programming Ideas for Libraries, Facilitators, Educators



Guide your community in becoming ES Apprentices!

Utilize Apprentice Training resources to host eclipse learning events. Each person can take the Apprentice Training quiz and earn their own Apprentice certificate afterwards!



Invite Patrons to be ES Observers!

- If you are handing out eclipse glasses, provide them with an Eclipse Soundscapes flyer and invite them to be Observers.
- Meet before and after with your community to talk about and submit observations on the ES website together.



Be an ES Data Collector in 2024!

- Put out AudioMoth on display several weeks before for patrons to look and touch.
- Choose a recording location together.
- Hang up a poster explaining that eclipse soundscapes are being collected and why. Then ask your community/group to write their ideas on what animal & insect changes they think will happen on the bottom of the poster.
- Sign up for Updates to be alerted of next free Data Collection Kit application!



Kit Cost: ~\$150



EclipseSoundscapes.org



[@EclipseSoundscapes](https://www.instagram.com/EclipseSoundscapes)



[@EclipseSoundUDL](https://twitter.com/EclipseSoundUDL)



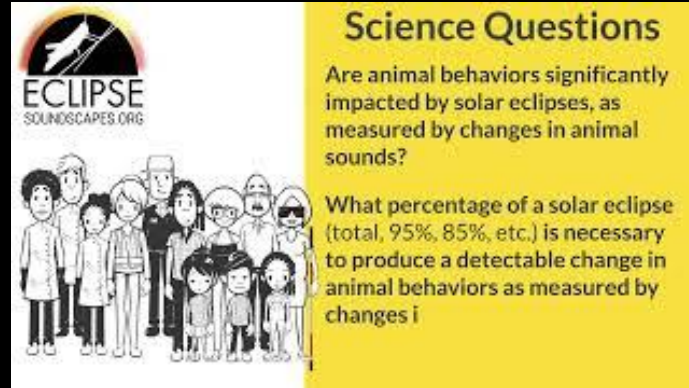
More info...

Participation Roles



Time: 2:20

The Science



Time: 3:26



EclipseSoundscapes.org   [@EclipseSoundscapes](https://www.facebook.com/EclipseSoundscapes)  [@EclipseSoundUDL](https://twitter.com/EclipseSoundUDL)

Eclipse Soundscapes is supported by NASA award No. 80NSSC21M0008





**6 million glasses
distributed free
through 13,000+ public libraries**

**Dennis Schatz
National Science Teaching Association (NSTA)
Solar Eclipse Activities for Libraries (SEAL)**



**National Science
Foundation**





<https://www.starnetlibraries.org/about/our-projects/solar-eclipse-activities-libraries-seal/>

NSTA Solar Eclipse Resource Website



The screenshot shows the NSTA website header with the logo, a search bar, and navigation links for Bookstore, My Library, Cart, and Menu. The main banner features a stylized solar eclipse graphic and the text 'Eclipse Guides, Resources, and More'. Below the banner, the text reads: 'Two Beautiful Eclipses Coming to North America! An Annular Eclipse in 2023 and a Total Eclipse in 2024'. A paragraph follows: 'Kick-start your planning for the upcoming eclipse events. Solar Eclipses are exciting astronomical events that can provide a great opportunity for teachers and students to learn about the science of astronomy and explore the beauty of the natural world. Check out the following collection of resources and teaching materials to use in the classroom.'

nsta Search for anything

Bookstore My Library Cart Menu

Eclipse

Guides, Resources, and More

Two Beautiful Eclipses Coming to North America!

An Annular Eclipse in 2023 and a Total Eclipse in 2024

Kick-start your planning for the upcoming eclipse events. Solar Eclipses are exciting astronomical events that can provide a great opportunity for teachers and students to learn about the science of astronomy and explore the beauty of the natural world. Check out the following collection of resources and teaching materials to use in the classroom.

<https://www.nsta.org/eclipse>



Educator and Administrator Guides Family/Friends Handout

The Great American Annular Eclipse of the Sun

Saturday, October 14, 2023

An information sheet by astronomers/educators Dennis Schatz & Andrew Fraknoi
Distributed courtesy of the National Science Teaching Association

On Oct. 14, 2023, there will be a dramatic annular eclipse visible to people on a narrow path from Oregon going southeast to Texas (see map below). A partial eclipse of the Sun will be visible to everyone in North and Central America, with a "digger" "bite" taken out of the Sun the closer you are to the path of the Sun. The Moon gets in front of the Sun, but it is too far away and, therefore, too small to cover it completely, leaving an annulus (or "ring of fire") around the dark disk of the Moon. We talked about the annular eclipse in class, so your child should be able to tell you more about what will happen in our location.

Most people in North America will see a partial eclipse.

Only those people in the narrow path of annularity will see the annular eclipse.

25

A Solar Eclipse Double-Header

October 14, 2023 and April 8, 2024

By Dennis Schatz and Andrew Fraknoi

Many people in the U.S. experienced the celestial beauty and sense of wonder of the 2017 total eclipse of the Sun. As the Moon crossed in front of the Sun, the Sun went dark, and the day suddenly turned into night. Whether you saw it or not, we have good news. Two solar eclipses are coming to North America soon—a "Double-Header"—on Saturday, October 14, 2023 (an annular—or ring-of-fire—eclipse) and Monday, April 8, 2024 (a total eclipse). Everyone not on the narrow eclipse path in North America will see a partial eclipse on both dates, where the Moon covers part of the Sun's surface.

To see the ring-of-fire during the annular eclipse, you will need to be in a 100-mile-wide path that stretches from the coast of Oregon to the southeast coast of Texas.

To see the solar corona (the Sun's faint atmosphere) during the total eclipse, you need to be in a 150-mile across path that starts in Mexico, crosses the U.S. in Texas and moves northeast through a number of states until leaving the U.S. from New York. From there it moves on to the eastern part of Canada.

Rarely does nature offer us such wonderful teachable moments, when our students can experience key science concepts while observing a spectacular sky event first hand. This Guide gives you the key information and links to other resources you need, so that you, your students, and your community can make the most of these two eclipses.

The following clickable Table of Contents allows you to go directly to each topic.

May you have clear skies and enthusiastic learners during the two eclipses.

Dennis Schatz
Andrew Fraknoi

FIGURE 1
Annular Eclipse Showing Ring of Solar Surface (Ring-of-Fire) Still Visible as Moon Passes in Front of the Sun
Photo by Scott Mink

FIGURE 2
Total Eclipse Showing Solar Corona as the Moon Passes in Front of the Sun and Completely Covers the Sun's Surface
Photo by Cary Beaudry (using August 2017 Photos)

nsta
National Science Teaching Association



Solar Eclipse Double-Header in October 2023 and April 2024

What School Administrators and Other Education Leaders Need to Know

Many people in the U.S. experienced the beauty and sense of wonder of the 2017 total solar eclipse—when the Moon crossed in front of the Sun. The Sun went dark, and the day turned into night. Now is the time to prepare for the next solar eclipses in North America—a "Double-Header" on Saturday, October 14, 2023 (an annular—or ring-of-fire—eclipse) and Monday, April 8, 2024 (a total eclipse). Rarely does nature offer us such clear teachable moments, when our students can experience key science concepts while observing a spectacular celestial event first hand.

In 2017, many administrators were unprepared when their science teachers asked to take students outside to view the eclipse. So, for the upcoming eclipses, we've prepared this document to give you the background you need to help your teachers make the two eclipses an unforgettable learning experience.

Annular eclipse showing ring of solar surface (Ring-of-Fire) still visible as Moon passes in front of the Sun
Photo by Scott Mink

Total eclipse showing solar corona as the Moon passes in front of the Sun and completely covers the Sun's surface
Photo by Cary Beaudry (using August 2017 Photos)

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National Science Teaching Association

Free Web Seminars

Recordings of the web seminars will be available post-event.



Safe Solar Eclipse Viewing Techniques and What School Administrators Need to Know

Thursday, September 14, 2023 •

7:30 PM ET



A Solar Eclipse 'Double-Header': The Perfect Way to Engage Your Preservice Teachers in Capitalizing on These Teachable Moments

Thursday April 27, 2023 • 7:00 PM

ET

SCIENCE
UPDATE



An Eclipse 'Double-Header' is Coming this School Year!

Thursday August 31, 2023 • 7:00 PM

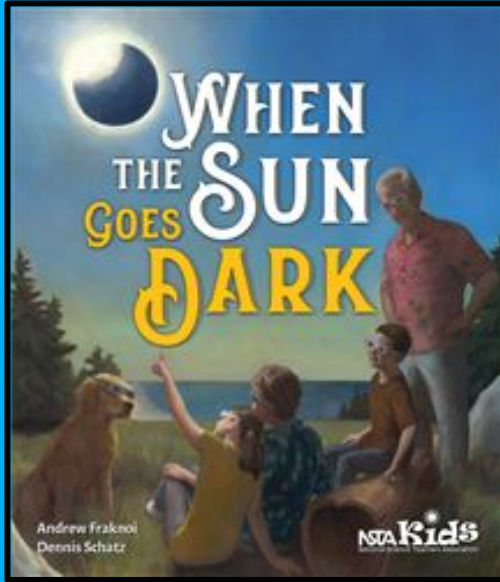
ET

SCIENCE
UPDATE

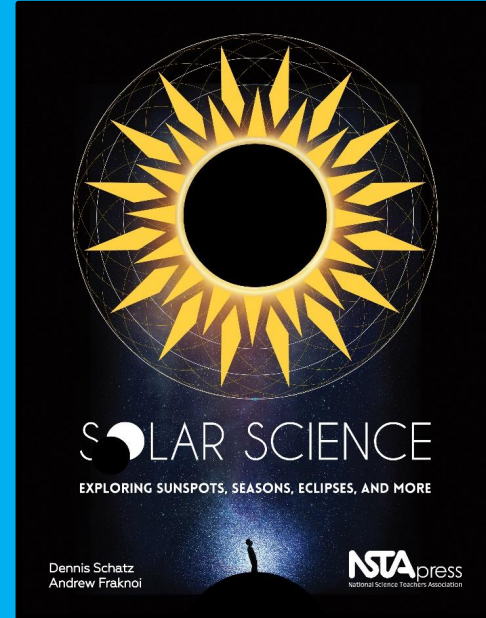


Getting Ready for Two Spectacular Solar Eclipses in North America

October 20, 2022



FOR CHILDREN



FOR TEACHERS

Journal Articles

Science & Children • Elementary

Preparing for the Eclipse: How to safely observe the Sun with young children

Science Scope • Middle School

July/August 2023 • Volume 46 • Issue 6

- Hurrah for Teachable Moments
- Preparing for the Great American Eclipse of 2024
- The 2023 and 2024 Solar Eclipse Double-Header
- Transitioning from Partial to Total Understanding
- Making the Most of the Upcoming Solar Eclipse Double-Header October 14, 2023, and April 8, 2024
- Megamovie 2024: A Project to Eclipse All Others

The Science Teacher • High School

Total_Eclipse: The solar eclipse this August is an ideal opportunity to practice three-dimensional science learning

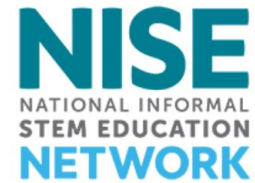


NSTA Collection

A Collection of external links curated by NSTA with additional resources related to solar eclipses.

[View Collection](#)

See what our fellow science friends have to offer.



Future Eclipse Resources from NSTA

1. Fall 2023 issue of NSTA's K-12 Journals dedicated to the eclipses
2. Sessions at the NSTA Conference in Kansas City (October 26 – 29, 2023)
3. Future NSTA web seminars

Administrator Guide



Solar Eclipse Double-Header in October 2023 and April 2024

What School Administrators and Other Education Leaders Need to Know

Many people in the U.S. experienced the beauty and sense of wonder of the 2017 total solar eclipse—when the Moon crossed in front of the Sun. The Sun went dark, and the day turned into night. Now is the time to prepare for the next solar eclipses in North America—a “Double-Header” on Saturday, October 14, 2023 (an annular—or ring of fire—eclipse) and Monday, April 8, 2024 (a total eclipse). Rarely does nature offer us such clear

teachable moments, when our students can *experience* key science concepts while observing a spectacular celestial event first hand.

In 2017, many administrators were unprepared when their science teachers asked to take students outside to view the eclipse. So, for the upcoming eclipses, we’ve prepared this document to give you the background you need to help your teachers make the two eclipses an unforgettable learning experience.



Annular eclipse showing ring of solar surface (ring-of-fire) still visible as Moon passes in front of the Sun

Photo by Kevin Baird



Total eclipse showing solar corona as the Moon passes in front of the Sun and completely covers the Sun's surface

Photo by Cary Brinkler during August 2017 Eclipse

What to Tell Administrators

It is important to inform your school administrators EARLY and OFTEN regarding plans related to the eclipses. Share the NSTA Administrators Guide and emphasize three things:

Eclipses are a Wonderful Learning Experience

Daytime Moon



Eclipses are Safe to View

Article in *Eclipse Retinopathy* in the journal *Eye* (2001)
15,148-151 © 2001 Royal College of Ophthalmologist

Research during the 1999 solar eclipse in the United Kingdom found:

“There were no recorded cases of permanent visual loss.”

Safe Eclipse-Viewing Techniques are Easy to Find and Use





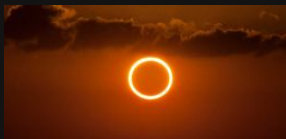
Eclipse Live Streams

Robyn Higdon, Exploratorium
September 12, 2023

Annular Eclipse: October 14, 2023



Live Stream from Ely, NV: Entire 3 hours of eclipse
Only images from telescopes: no commentary, interruptions, or audio
Close-ups (1/4 disc) and full disc in H-Alpha and white light



From Valley of the Gods, UT: Entire 3 hours of eclipse with Live Sonification
Only images from telescopes: no commentary or interruptions
Close-ups (1/4 disc) and full disc in H-Alpha and white light



From Valley of the Gods, UT: One Hour 'Show'
ENGLISH Educational Program with Educators, NASA scientists, Navajo knowledge holders, and live imagery from the telescopes



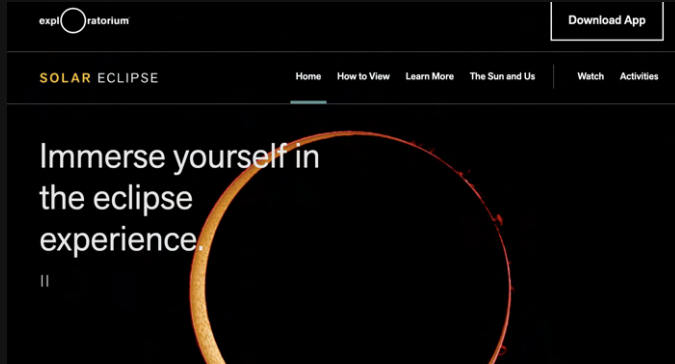
From Valley of the Gods, UT: One Hour 'Show'
SPANISH Educational Program with Educators, NASA scientists, Navajo knowledge holders, and live imagery from the telescopes



When do the streams start?

| | PDT | MDT | CDT | EDT |
|-----------------|-------------------------|---------------------------|---------------------------|---------------------------|
| Telescope Start | 8:00 AM | 9:00 AM | 10:00 AM | 11:00 AM |
| Program Start | 9:00 AM | 10:00 AM | 11:00 AM | Noon |
| Annularity | 9:24 (NV), 9:29 (UT) | 10:24 (NV), 10:29 (UT) | 11:24 (NV), 11:29 (UT) | 12:24 (NV), 12:29 (UT) |
| Program Ends | 10:00 AM | 11:00 AM | Noon | 1:00 PM |
| Telescope Ends | 11:00 AM | Noon | 1:00 PM | 2:00 PM |

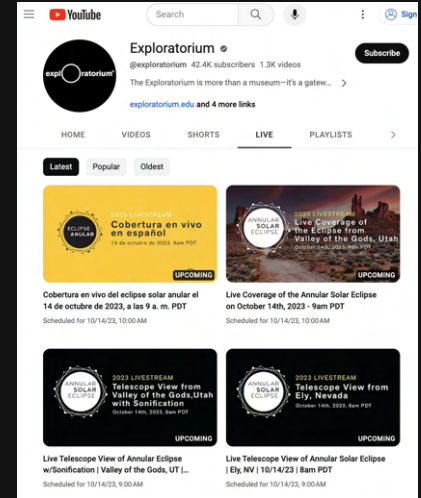
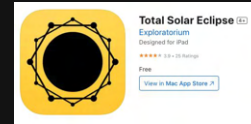
How to access the streams:



www.exploratorium.edu/eclipse



Total Solar Eclipse App
for iOS and Android



[Exploratorium's
YouTube Channel](https://www.youtube.com/channel/UC...)

Ideas for Use:



The Telescope Feeds: Use on Museum Screens

- Use as a backdrop for your educators to speak about the eclipse
- Send to screens at admissions or in galleries to create excitement
- Take screen captures and post on social media
- Play on monitors outdoors to give visitors a chance to see close ups



The App: Use it while observing outdoors!

- Watch stunning close-ups of the sun
- Watch annularity in places where it may be partial
- Watch it before/after annularity in your location



The Programs: Stand Alone Programs

- Screen in your theater for a turnkey public program
- Show the Spanish show to increase access

In partnership with the Indigenous Education Institute, we have developed content about the unique way the Navajo (Diné) experience the eclipse.

Navajo Knowledge of the Cosmos



Is'aa - Navajo Basket

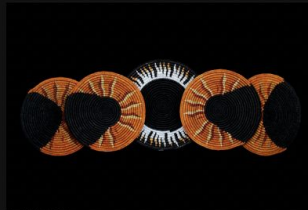
For generations, Navajo (Diné) people have studied the sky and passed down its stories.

"Navajo star knowledge is based on a world view and cosmology significantly different from western academic astronomy. Navajo astronomy can best be understood within a much larger context of Navajo philosophy. The Navajo world view includes a holistic ordered universe where everything is interrelated and all the pieces of the universe enfolded within the whole. At the same time every piece contains the entire universe creating a network of relationships and processes in constant flux. Unlike western astronomy, traditional Navajo astronomy is highly spiritual in accordance with a world view where everything is considered living and sacred."

- Nancy C. Maryboy, Ph.D., Indigenous Education Institute (IEI)

In Navajo (Diné) tradition, the eclipse marks a sacred time.

Solar eclipses are compelling astronomical events that connect us to the Sun and the Moon in powerful ways. Annular or total solar eclipses, and even partial ones, can leave lasting memories of the phenomenon as well as the people and places where we experience the celestial alignment. The 2023 annular solar eclipse will pass through indigenous lands in the United States "four corners" region. In collaboration with Navajo (Diné) astronomers of the Indigenous Education Institute, the Exploratorium will create resources that feature solar eclipses from the Navajo worldview. Learn about the cultural significance and scientific understandings of eclipses as told by Navajo educators, astronomers, and elders.



Credit: Elise Holiday



A Time for Renewal - Navajo (Diné) Knowledge of Eclipses

Jóhonaa'éí éí T'í'ehonaa'éí
altsoh yich'áah iiyááh.

Navajo (Diné) Eclipse Phrases

Traditional Navajo (Diné) knowledge teaches us that eclipses have always been a part of the human experience.

"When an eclipse begins, Navajo elders strongly instruct their community to go inside the hogan (their traditional dwelling) to ensure they don't look up at the Sun. It is considered a time of interaction between the Sun and the moon. They sit quietly and in contemplation, or recount traditional teachings about the origins of the Sun and moon. These practices are grounded in their deeply held respect for the cosmic order."

- Nancy C. Maryboy, Ph.D. and David Begay, Ph.D., Indigenous Education Institute (IEI)



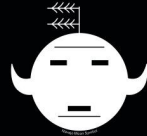
"Annular Solar Eclipse" - poster

This poster was developed in collaboration with the Indigenous Education Institute. This educational "Annular Solar Eclipse" poster gives voice to Navajo knowledge of solar eclipses and features the Diné language and descriptions of eclipses from the Navajo worldview.

We invite you to [download](#) this beautiful poster!



Please
download, print,
and share our
beautiful poster



Jóhonaa'éei dóó Nahasdzáán dóó T'í'ehooq
naa'éei 1k'áaniikahgo, Jóhonaa'éei T'í'ehooq
naa'éei bichaha'oh áyiilííh Nahasdzáán
bikáají. Éiyee lahgo át'íil'íih.

The interaction and alignment of the Sun and the Moon create
a shadow (bichaha'oh) on the Earth, causing an eclipse.

1 Jóhonaa'éei lahgo át'íillyaa.
The Sun made itself different.

2 T'í'ehonaa'éei Jóhonaa'éei
yicháán iyáágo, Jóhonaa'éei
bee adinidínee ádin sillí.
The Sun ceases to exist with
a full light.

3 Jóhonaa'éei dóó T'í'ehonaa'éei
at'ááh níní' ááq.
The Sun and the Moon aligned
with each other.

4 Jóhonaa'éei T'í'ehonaa'éei
yine'ílyá.
The Sun went behind the Moon.

5 T'í'ehonaa'éei shá bee
adinidín binázt'í sillí.
Sunlight goes all the way around
the Moon in a ringlike shape.

6 T'í'ehonaa'éei Jóhonaa'éei
aitxó yik'ááh niniyá.
The Moon completely covered
the face of the Sun.

7 Jóhonaa'éei lahgo
át'íillyaayée hanáádzá.
The Sun came back out of
the eclipse.

8 T'í'ehonaa'éei dóó Nahasdzáán
bichaha'oh áyíllaa.
Its shadow—of either the
Moon or the Earth.

ANNULAR SOLAR ECLIPSE | October 14, 2023



EXPLORATORIUM.EDU/ECLIPSE

Why Study Eclipses?

During a solar eclipse, the Moon passes between the Sun and Earth, blocking out all or part of the Sun's light. This is a rare event that occurs only once every 18 months or so for any given location on Earth. It is a great opportunity to study the Sun, the Moon, and the Earth's atmosphere.



Science, eclipses, and shadows (bichaha'oh)

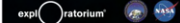
During a solar eclipse, the Moon passes between the Sun and Earth, blocking out all or part of the Sun's light. This is a rare event that occurs only once every 18 months or so for any given location on Earth. It is a great opportunity to study the Sun, the Moon, and the Earth's atmosphere.

Annular solar eclipse in Navajo Country

The Navajo Nation is one of the few places in the world where an annular solar eclipse will be visible on October 14, 2023. This is a rare event that occurs only once every 300 years or so for any given location on Earth. It is a great opportunity to study the Sun, the Moon, and the Earth's atmosphere.

Eye safety during a solar eclipse

Never look directly at the Sun without protective eyewear. The Sun's rays can cause permanent eye damage, even if you only look for a few seconds. Use proper eye protection during an eclipse.



EXPLORATORIUM.EDU/ECLIPSE

Thank You.

Contact: Robyn Higdon rhigdon@exploratorium.edu



Two Moon Shadows You Won't Want to Miss

October 14, 2023
&
April 8, 2024

Vivian White
Astronomical Society of the Pacific,
Night Sky Network, Eclipse Ambassadors

solarsystem.nasa.gov/eclipses



The Whole US Sees a Partial Eclipse

If it's clear out...



And if not, don't worry -
we have you covered!

[exploratorium.edu/
eclipse](https://exploratorium.edu/eclipse)



Involve Your Community



Plan a
Partial Eclipse
Party

bit.ly/partialeclipseparty



This is a *Total Eclipse*



ONE NATION UNDER THE SUN

PARTNER undergraduates and eclipse enthusiasts
DISCOVER eclipse outreach opportunities together
INSPIRE your community with awe - *in advance*!



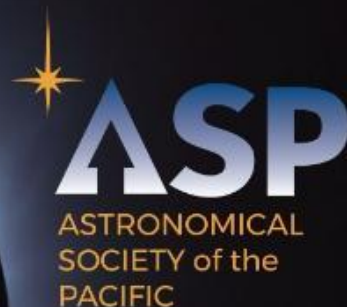
Partner

Apply today!

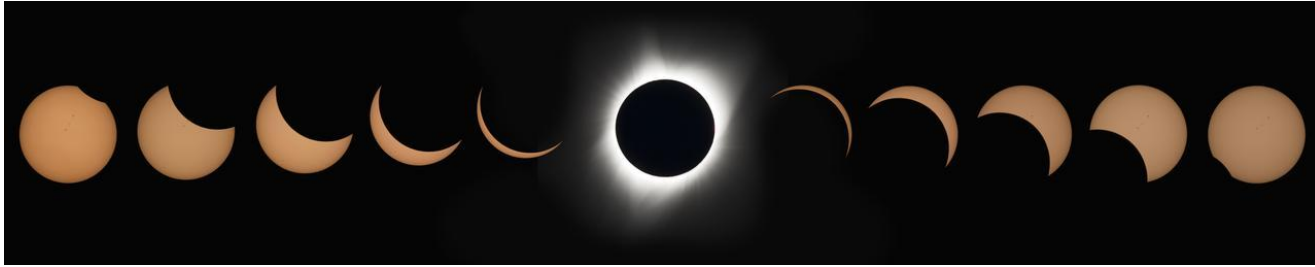
**ECLIPSE
AMBASSADORS**

eclipseambassadors.org

**No eclipse-day
commitments*



NISE Network Solar Eclipse Resources



Compilation of Eclipse public engagement resources:

- Hands-on activities
- Maps and images
- Safe viewing
- NASA's Solar Eclipse Tactile book
- Cultural connections and more!



nisenet.org/solareclipse

Companion Apps with Hands-on Activities

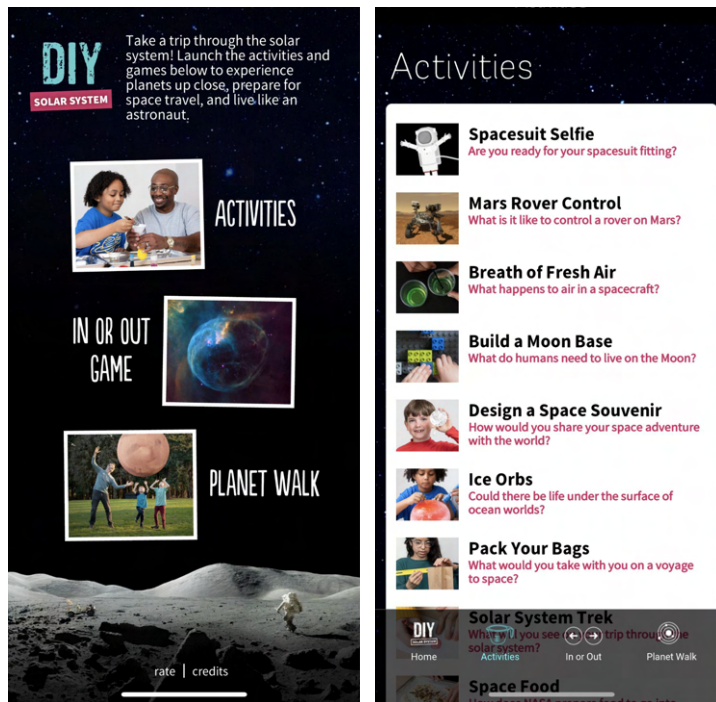
DIY Sun Science

English & Spanish

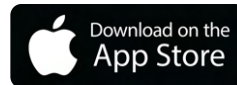


DIY Solar System

English (Spanish coming soon)



Both available
for **iPhones**
& **iPads**



DIY Sun Science
available for
Android

DIY Solar
System for
Android

Coming Soon!

nisenet.org/diy-solar-system-app

nisenet.org/diy-solar-system-app

NEW - Preparing for a Solar Eclipse Presentation

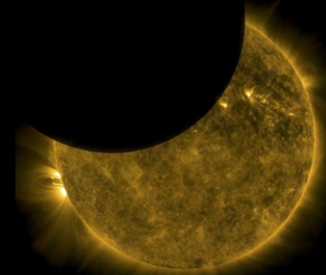
Preparing for a Solar Eclipse



Credit: NASA Goddard

Presentation Overview

- What are solar eclipses
- How to enjoy a solar eclipse safely
- Solar eclipse resources for everyone



SDO/AIA 171 2010-10-07 11:58:35 UT

Credit: NASA Goddard

Everyone Can Participate in a Solar Eclipse!



Credits: Science Museum of Minnesota and Emily Maletz for NISE Network

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Thank You



Q&A

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