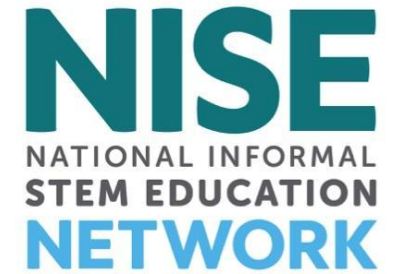


NISE Network Online Workshop

Kick-Start Your Planning for 2023 and 2024 Solar Eclipse Events

October 25, 2022



Today's Presenters:

Christina Leavell, NISE Network Community Manager, Arizona State University

Dr. Laura Peticolas, Sonoma State University, NASA's Neurodiversity Network (N3)

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

MaryKay Severino, ARISA Lab LLC., Eclipse Soundscapes: Citizen Science Project

Vivian White, Astronomical Society of the Pacific, NASA Night Sky Network

Dennis Schatz National Science Teachers Association (NSTA)

Robyn Higdon, Exploratorium, Navigating the Path of Totality Program



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

See you in 2023!

Upcoming Events:

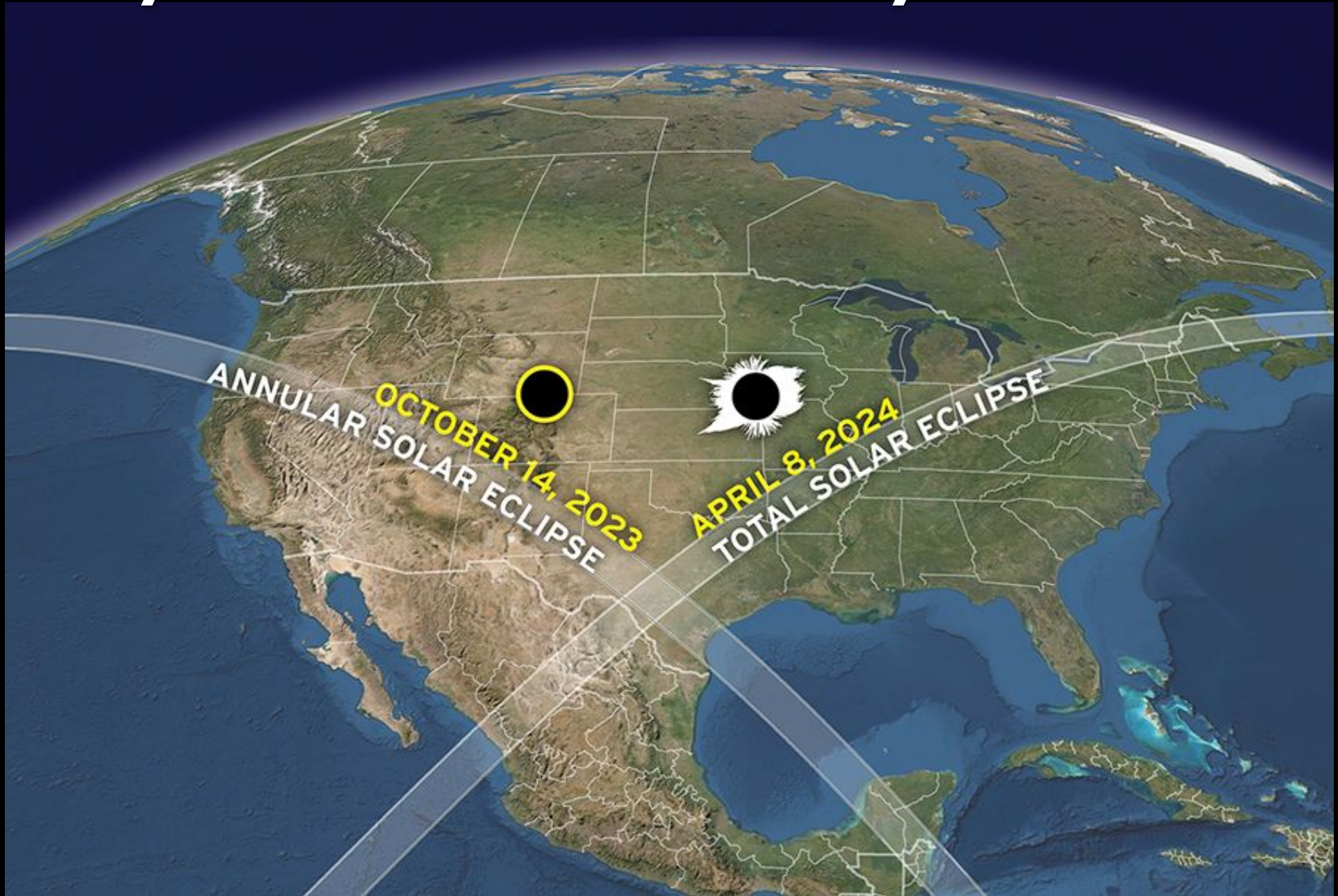
nisenet.org/events

Recordings of all Online Workshops:

nisenet.org/online-workshop-recordings



If you haven't already heard...



Safety First!

- Never look directly at the sun without appropriate protection.
- Use eclipse glasses & handheld solar viewers.
- Be sure to purchase ISO certified eclipse glasses and hand-held solar viewers that meet safety standards.
- Do not use homemade filters or sunglasses.



nisenet.org/solareclipse

DIY Sun Science

DIY SUN SCIENCE

Have fun investigating the Sun! Conduct 15 hands-on activities using common household items, explore photos and videos from NASA, and view live images of the Sun!

Español

Use a pin to help you measure the Sun's size

LIVE!
Sun Cam

Cook with the Sun using aluminum foil

rate
credits

IMAGES+VIDEOS

SUN OBSERVATORY

ACTIVITIES

Solar Convection



What causes solar granules on the Sun?

Use hot and cold water to see how fluids at different temperatures move around in convection currents.

AGE LEVEL: ages 10 and up



Preparation: 5 minutes
Activity: 10 minutes
Cleanup: 5 minutes

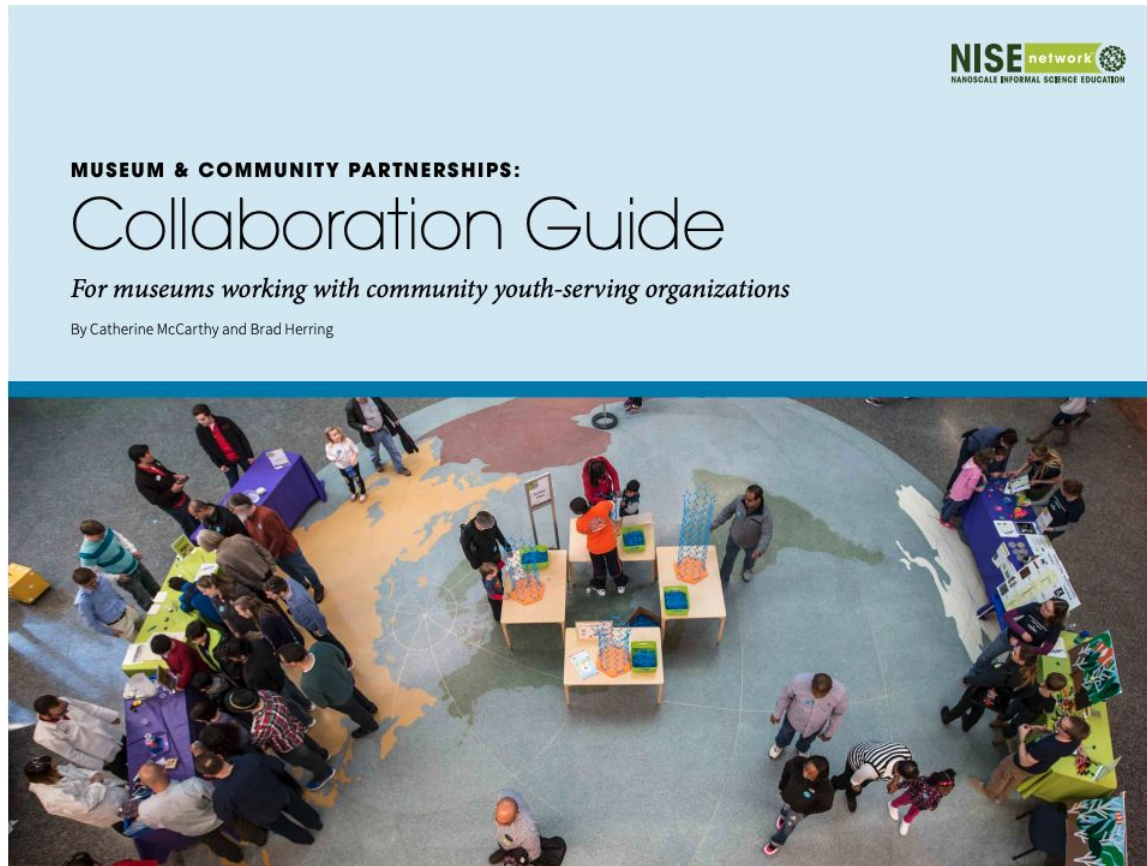
nisenet.org/solareclipse

Affordable Eclipse Glasses

- **Advice from NASA & the Museum Informal Education Alliance:**
<https://informal.jpl.nasa.gov/museum/content/solar-viewing-glasses> (log-in required)
- **Libraries & STARnet:**
<https://www.starnetlibraries.org/about/our-projects/solar-eclipse-activities-libraries-seal/>
- **Sources:**
 - Rainbow Symphony
 - American Paper Optics
 - Thousand Oaks Optical
 - EclipseGlasses.com (educator discount)



A Community Effort



nisenet.org/solareclipse



Science of Solar Eclipses

Dr. Laura Peticolas

Space Physicist, Educator, Curriculum Developer, and Manager

NASA's Neurodiversity Network

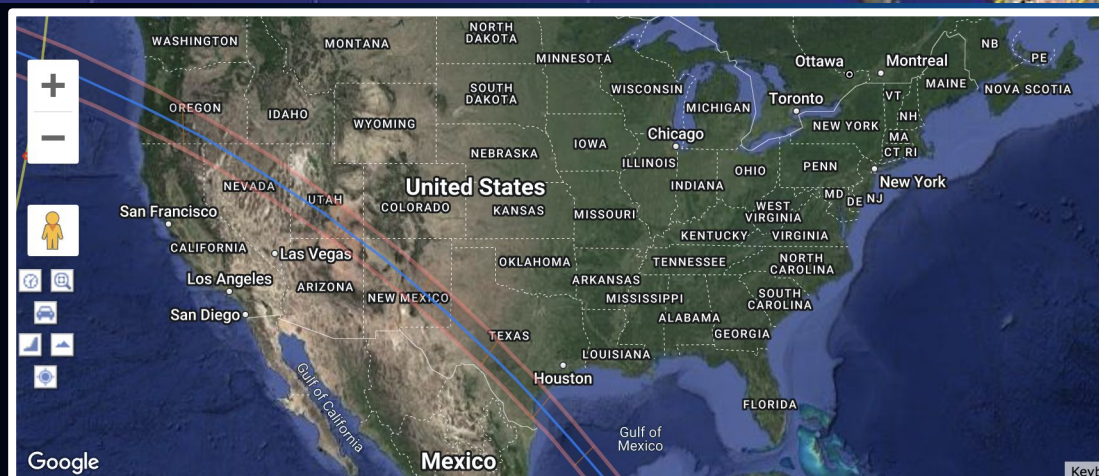
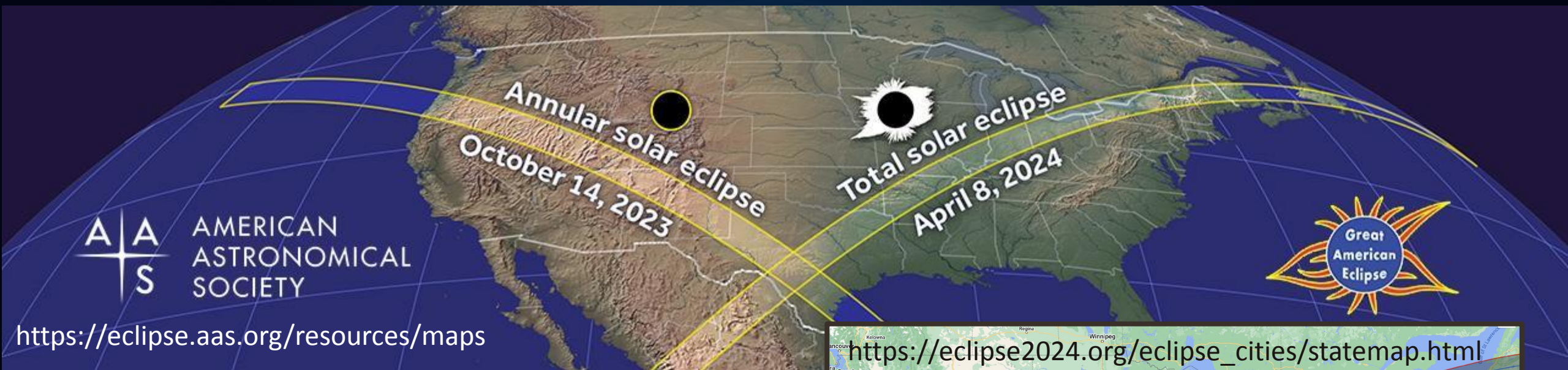
American Astronomical Society Solar Eclipse Task Force Member

Sonoma State University



Eclipse Maps

What are these maps showing?





What are Annular Solar Eclipse Maps Showing?



Partial Solar Eclipse

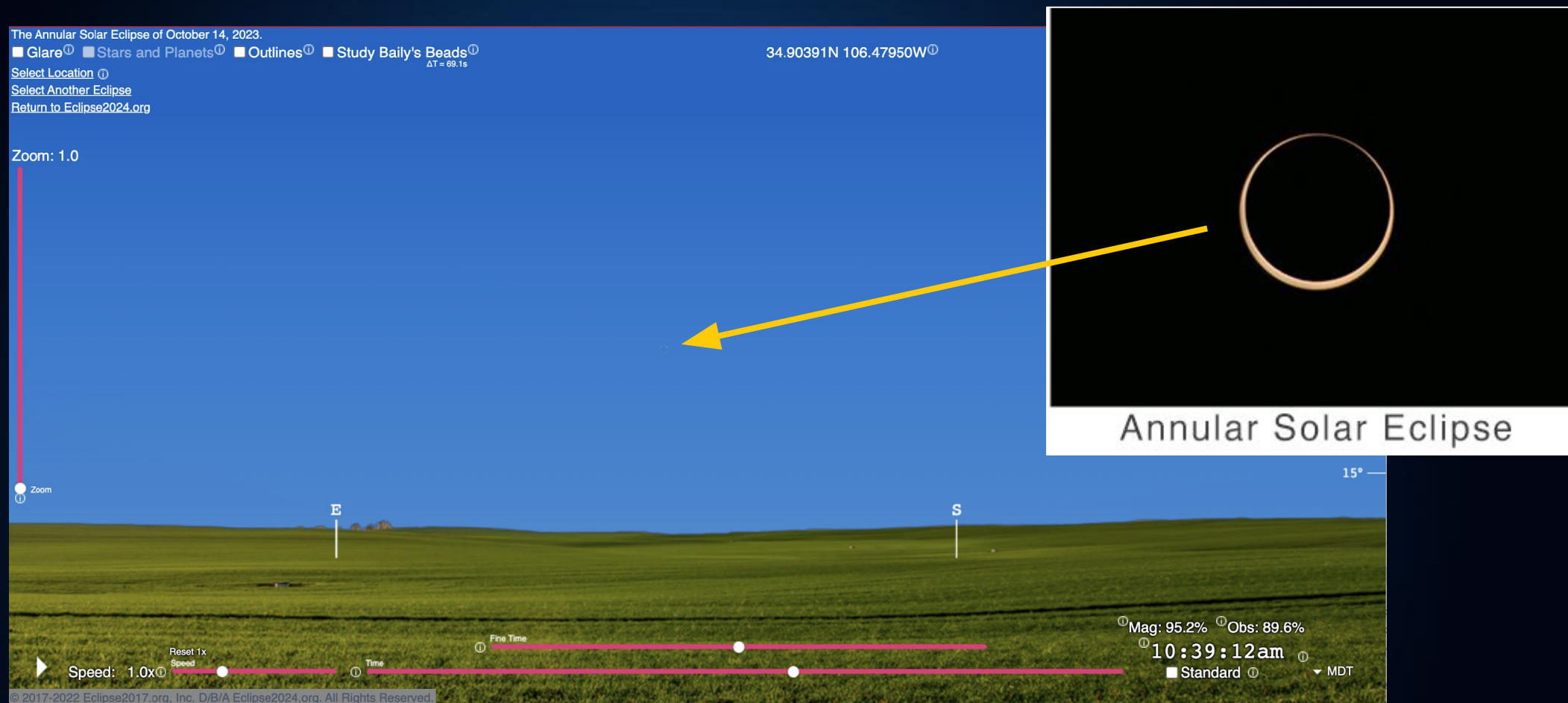


Annular Solar Eclipse

- The maps show the locations on Earth where the annular solar eclipse can be experienced
- Most people will experience a partial solar eclipse
- People in the path of annularity will *ALSO* experience an Annular Solar Eclipse
- Never look directly at the Sun during a Partial or Annular Solar Eclipse



Dan McGlaun's Simulation 2023 Annular Solar Eclipse



Albuquerque, NM

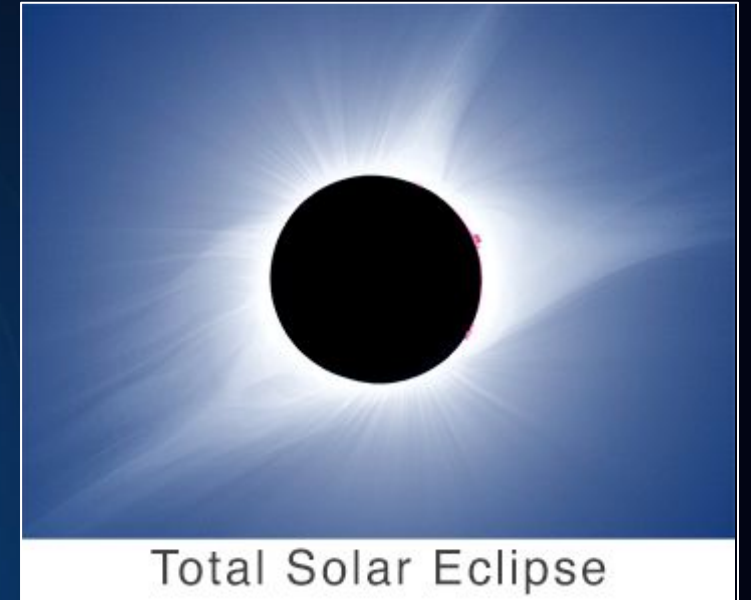
https://eclipse2024.org/eclipse_cities/statemap.html



What are Total Solar Eclipse Maps Showing?



Partial Solar Eclipse

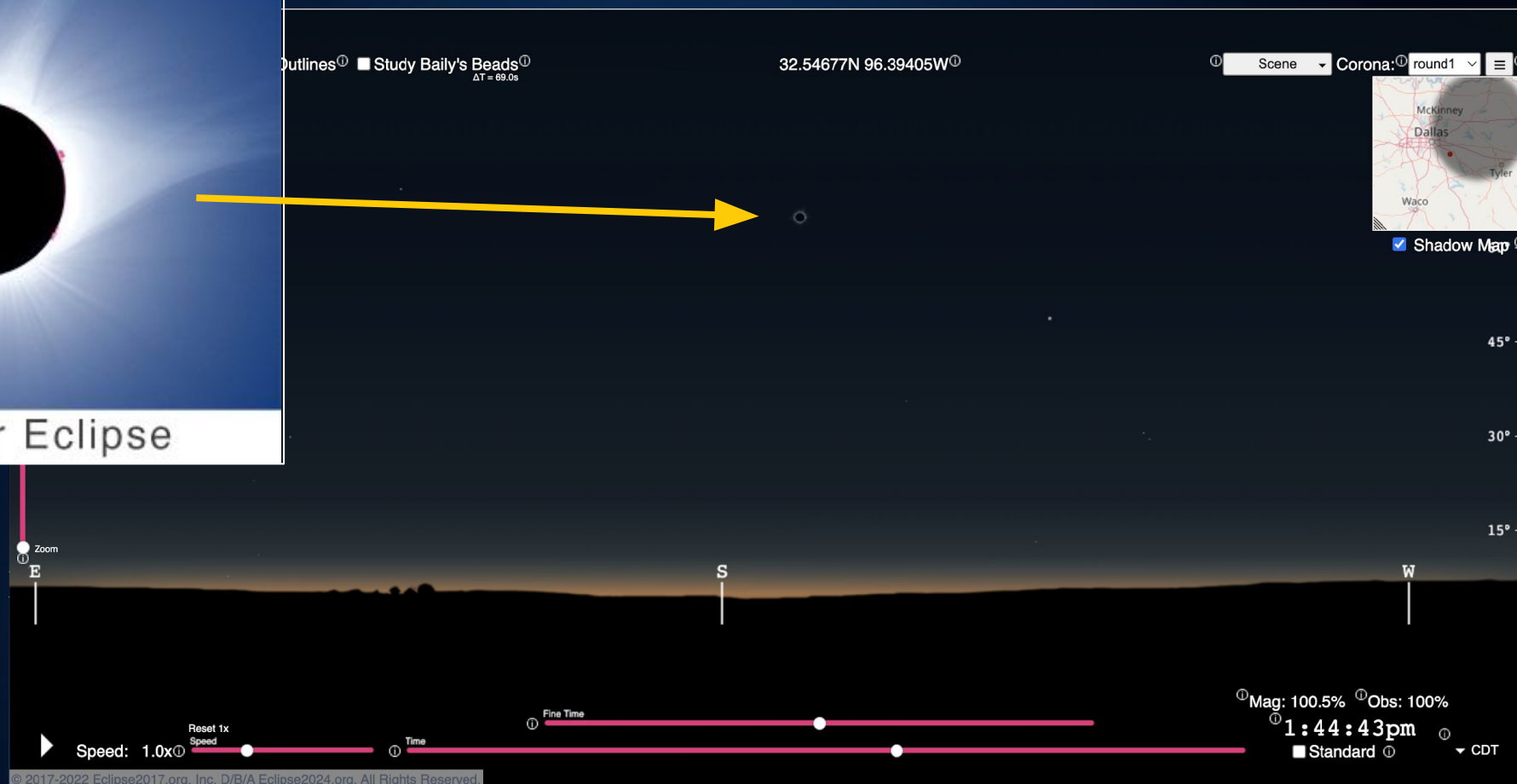
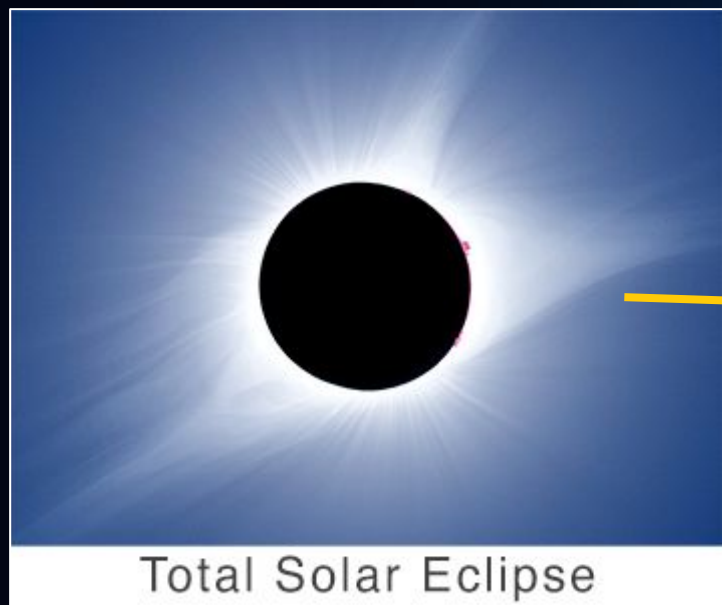


Total Solar Eclipse

- The maps show the locations on Earth where the total solar eclipse can be experienced
- Most people will experience a partial solar eclipse
- People in the path of totality will *ALSO* experience a Total Solar Eclipse
- Never look directly at the Sun during a Partial Solar Eclipse
- *Always look directly at the Moon during a Total Solar Eclipse (take off eclipse/solar viewing glasses)*



Dan McGlaun's Simulation 2024 Total Solar Eclipse



Outside Dallas, TX

https://eclipse2024.org/eclipse_cities/statemap.html



Moon Shadow April 8th, 2024

SONOMA STATE
UNIVERSITY



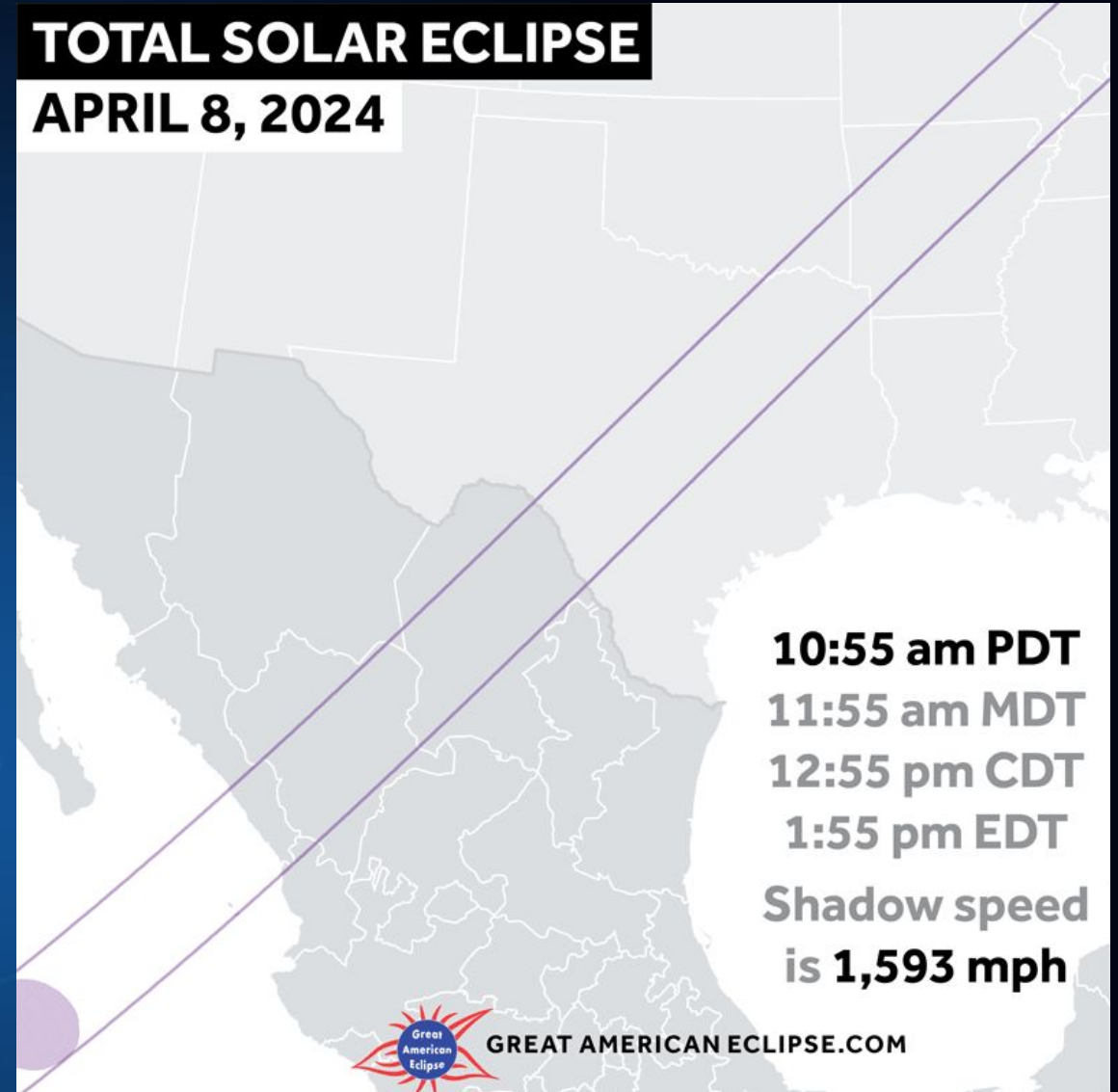
A photo from Solar Eclipse NISE network activity.



A photo of the Moon's shadow from the Mir spacecraft during the 1999 eclipse.

TOTAL SOLAR ECLIPSE

APRIL 8, 2024

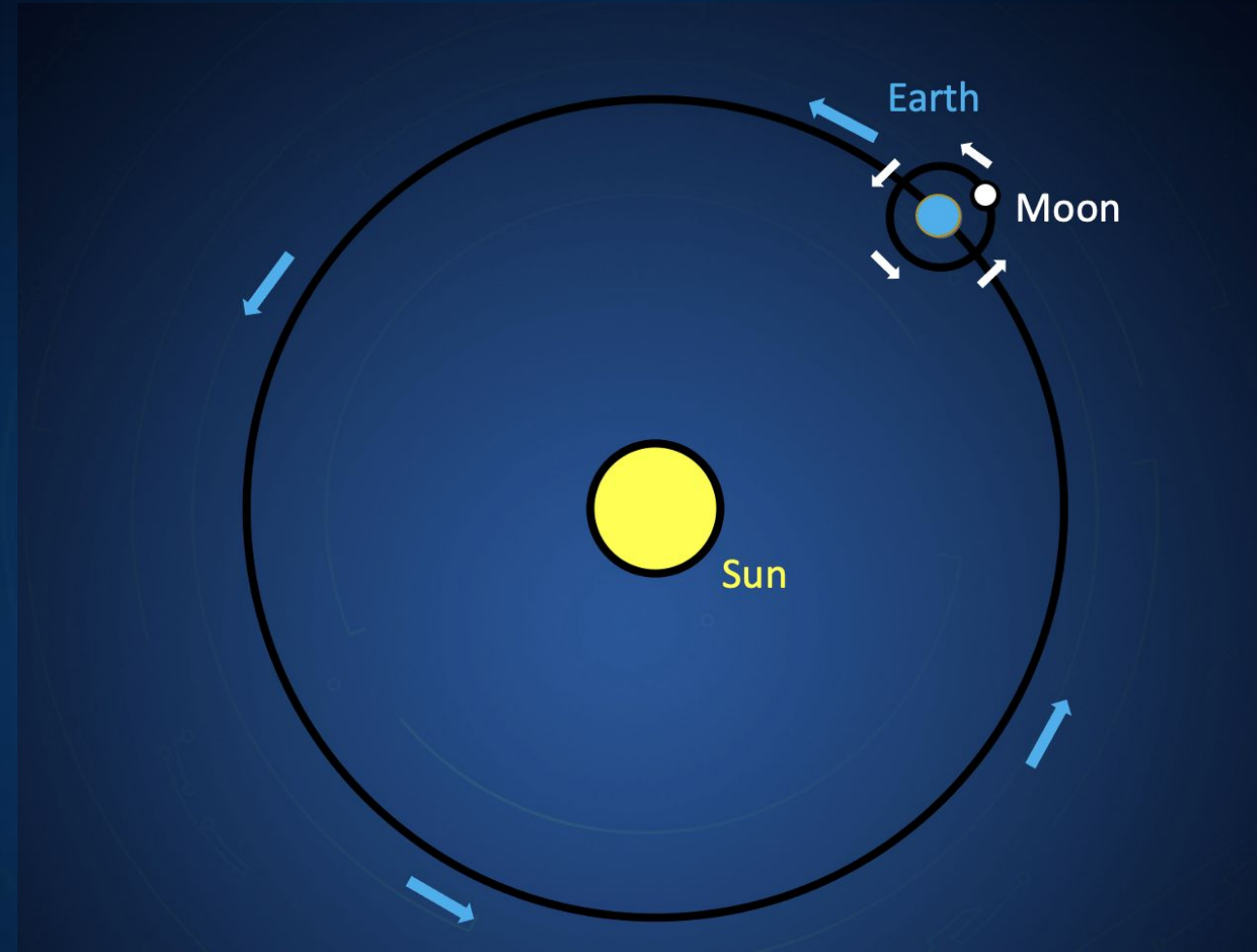


Prediction of the 2024 Moon's shadow traversing the U.S.A.
<https://www.greatamericaneclipse.com/april-8-2024>



Orbital Mechanics

What circles what?



Looking “down” on Sun-Earth-Moon system, with Earth’s north pole in view (NOT TO SCALE)



Apparent Size of the Moon and Sun in the Sky



Maximum changes in the apparent size of the Moon and the Sun in the sky. This is as big and small as the Sun appears in the sky. It also shows as big and small as the moon appears in the sky. Diagram Rick Feinberg. <https://eclipse.aas.org/eclipse-america/how-why>. CC4.0.

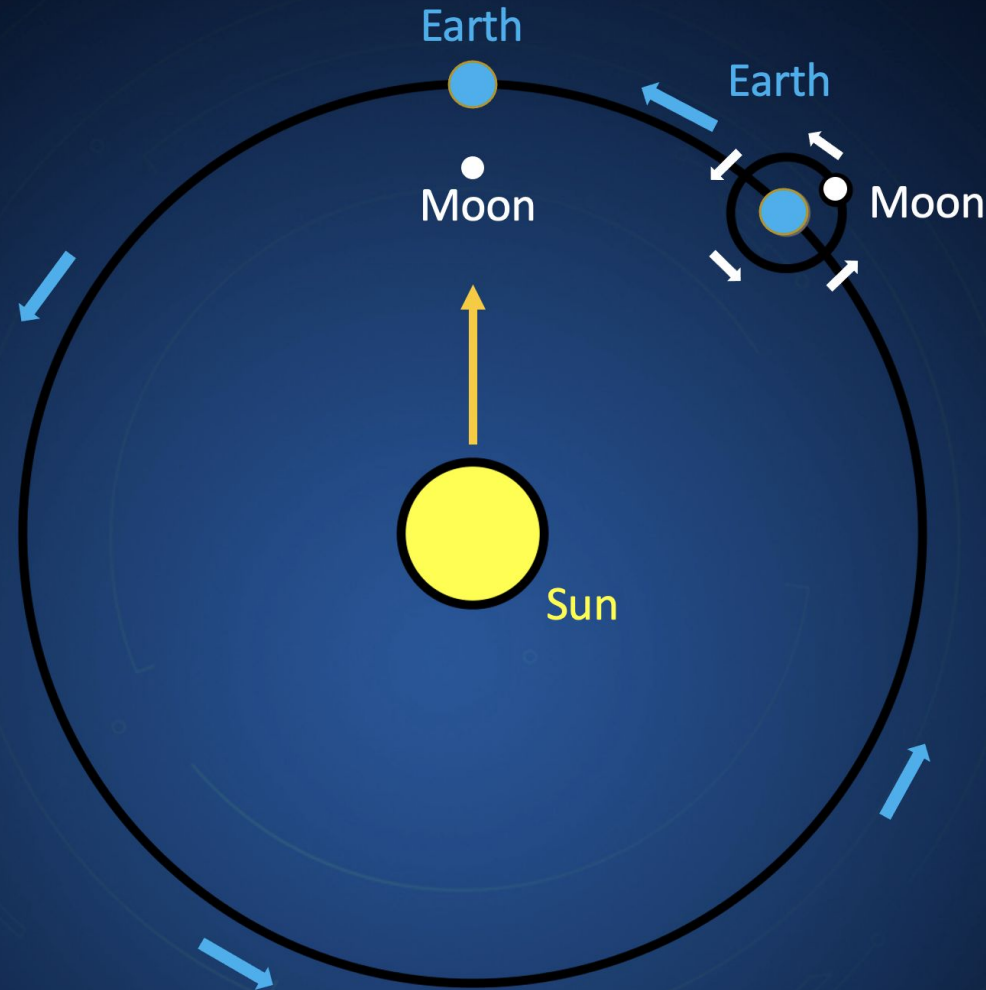


Orbital Mechanics

What circles what?



Maximum changes in the apparent size of the Moon and the Sun in the sky.



Looking "down" on Sun-Earth-Moon system, with Earth's north pole in view (NOT TO SCALE)



Modeling apparent size in
Big Sun, Small Moon activity
NISE networks activity



Annular Solar Eclipse

The Moon Mostly Blocks the Photosphere of the Sun

space.rice.edu/eclipse/
reiff@rice.edu

ANNULAR ECLIPSE

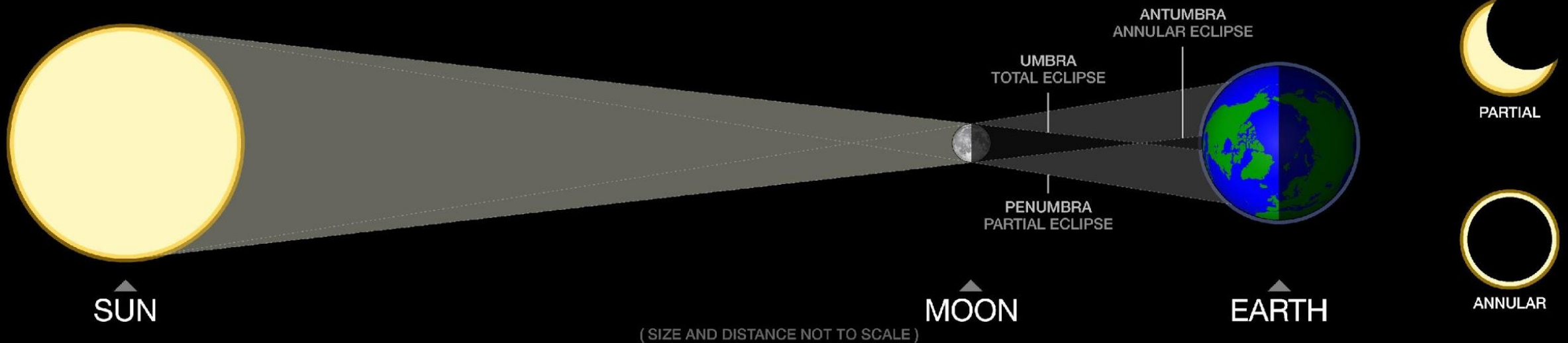
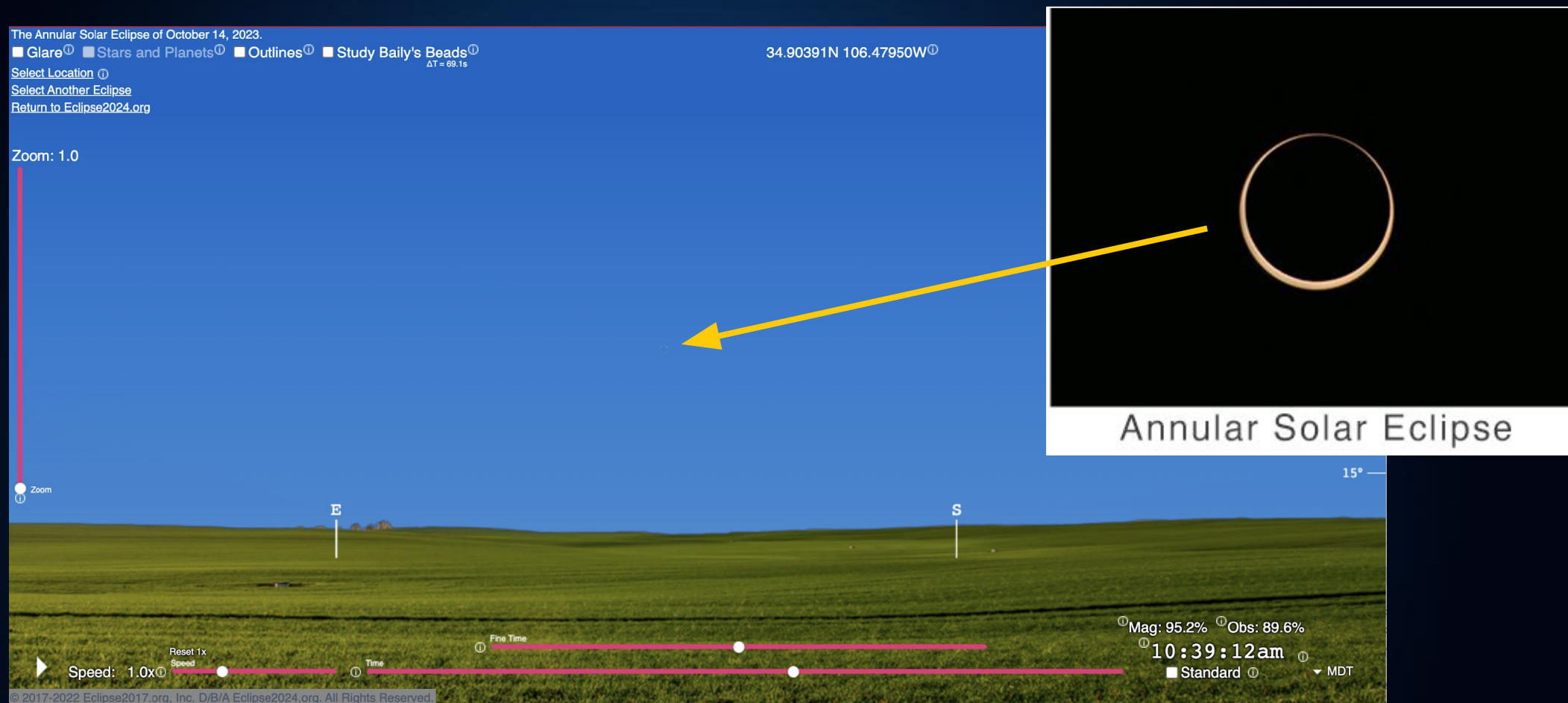


Diagram by Colin Law with NASA support under Reiff direction. https://space.rice.edu/eclipse/eclipse_graphics.html. CC4.0.

An annular solar eclipse allows plenty of sunlight from the Sun's Photosphere to scatter through our atmosphere.



Dan McGlaun's Simulation 2023 Annular Solar Eclipse



Albuquerque, NM

https://eclipse2024.org/eclipse_cities/statemap.html



Total Solar Eclipse

The Moon Completely Blocks the Photosphere of the Sun

space.rice.edu/eclipse/
reiff@rice.edu

SOLAR ECLIPSE

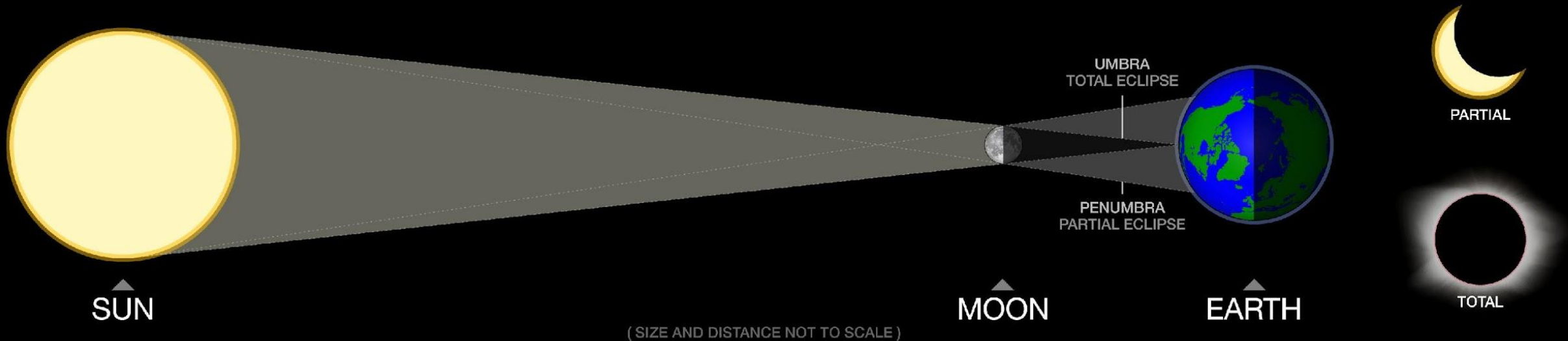
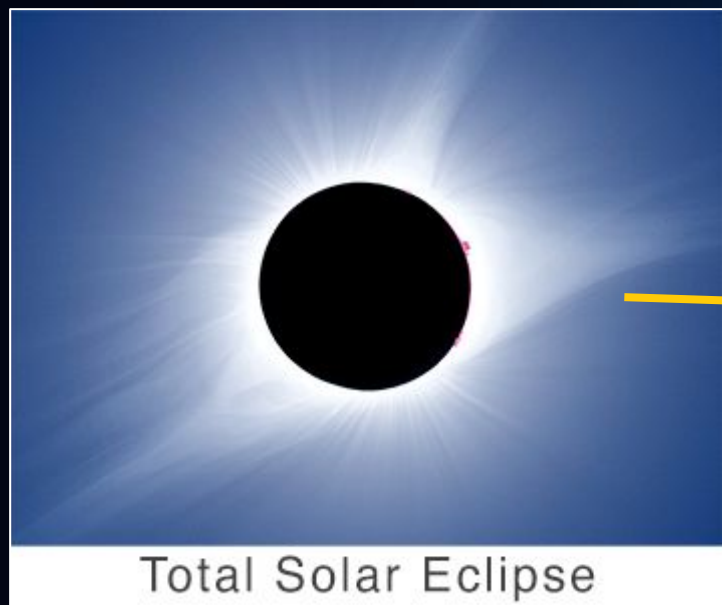


Diagram by Colin Law with NASA support under Reiff direction. https://space.rice.edu/eclipse/eclipse_graphics.html. CC4.0.

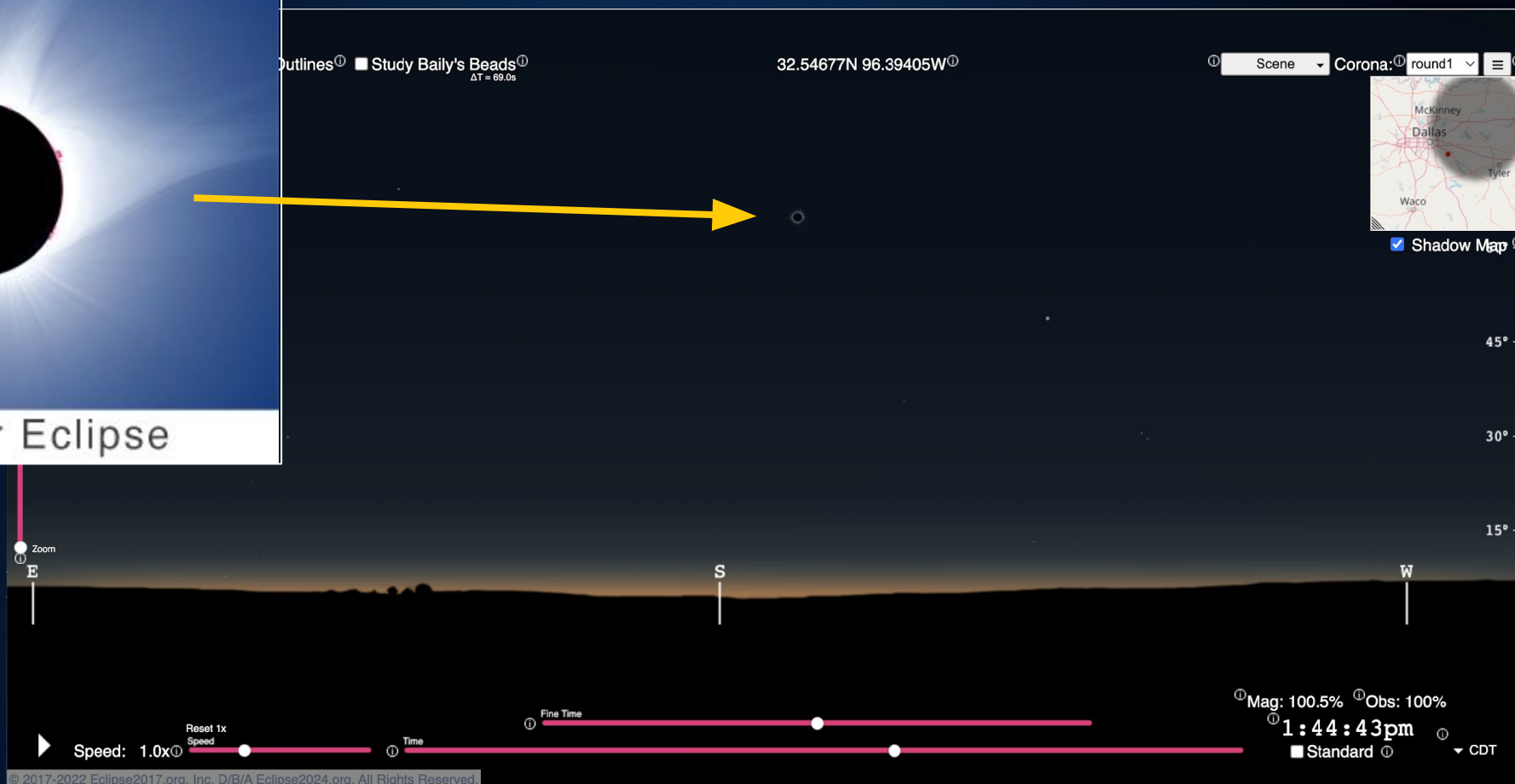
A total solar eclipse reveals the Sun's Corona, typically hidden by sunlight scattered through our atmosphere.



Dan McGlaun's Simulation 2024 Total Solar Eclipse



Total Solar Eclipse



Outside Dallas, TX

https://eclipse2024.org/eclipse_cities/statemap.html



NASA Heliophysics Education Activation Team

and Eclipse Coordination

October 25, 2022



Carolyn Ng
Informal Educator;
Collaborations Lead



Michael Kirk
PI; Heliophysicist



Christina Milotte
Formal Educator



Shannon Reed
Program Manager



Lani Sasser
Data/Information
Specialist



Kelly Korreck
NASA HQ,
Heliophysicist,
NASA Eclipse POC



Hilarie Davis
Education Consultant



Sten Odenwald
Technical Writer;
Subject Matter Expert

NASA GSFC Team Members



GOALS



Collect

- Content, best practices, lessons learned
- Interdisciplinary examples of heliophysics



Generate

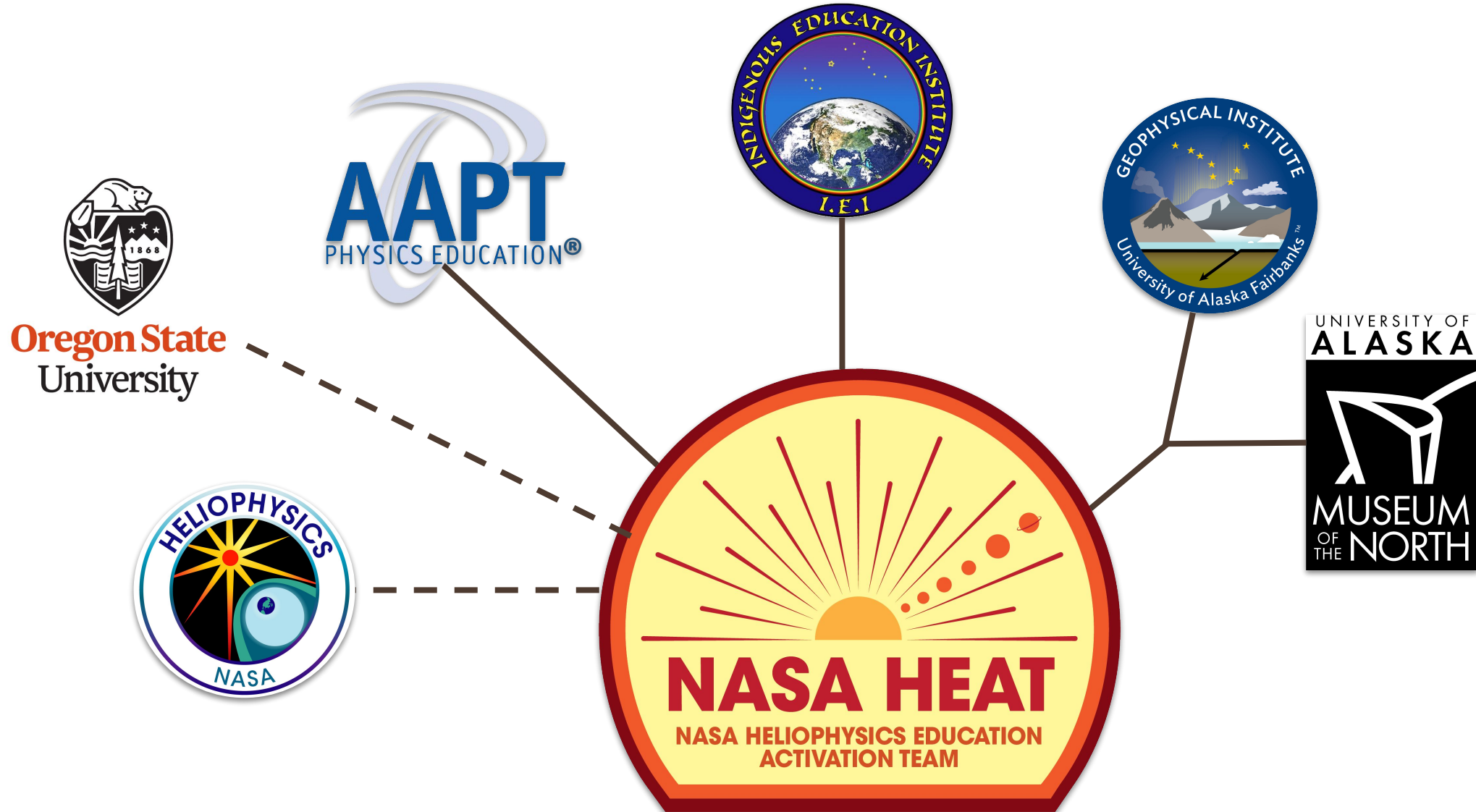
- Database of heliophysics-specific resources
- A comprehensive suite of easily accessible NASA assets for K-12 educators



Engage

- Broad audiences across the US with particular attention toward underserved communities
- The public by using the 2023 and 2024 eclipses to create and sustain interest in heliophysics

CO-INVESTIGATING INSTITUTIONS



National Aeronautics and
Space Administration



ECLIPSE
●●●●○●●●●
2023 THROUGH THE EYES OF NASA

NASA needs you in 2023 and 2024

2024 Total Solar
eclipse

NASA Resources

- Glasses
- Maps
- Digital Resources
 - Fact Sheet
 - Safety Flyer
 - Education bundles
 - NASA Science
 - Website
- Training
- Live Streaming from “Sunspots”

National Aeronautics and Space Administration



Experience a Solar Eclipse



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.

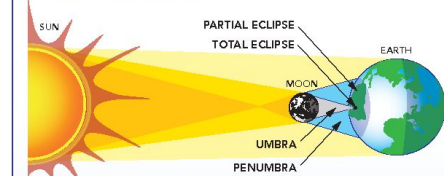
Known as a hybrid eclipse, sometimes an eclipse can shift between annular and total as the Moon's shadow moves across Earth's surface.

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.



TOTAL SOLAR ECLIPSE



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/342otv5>

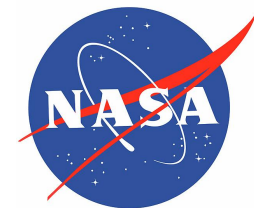


HOW LONG WILL IT LAST

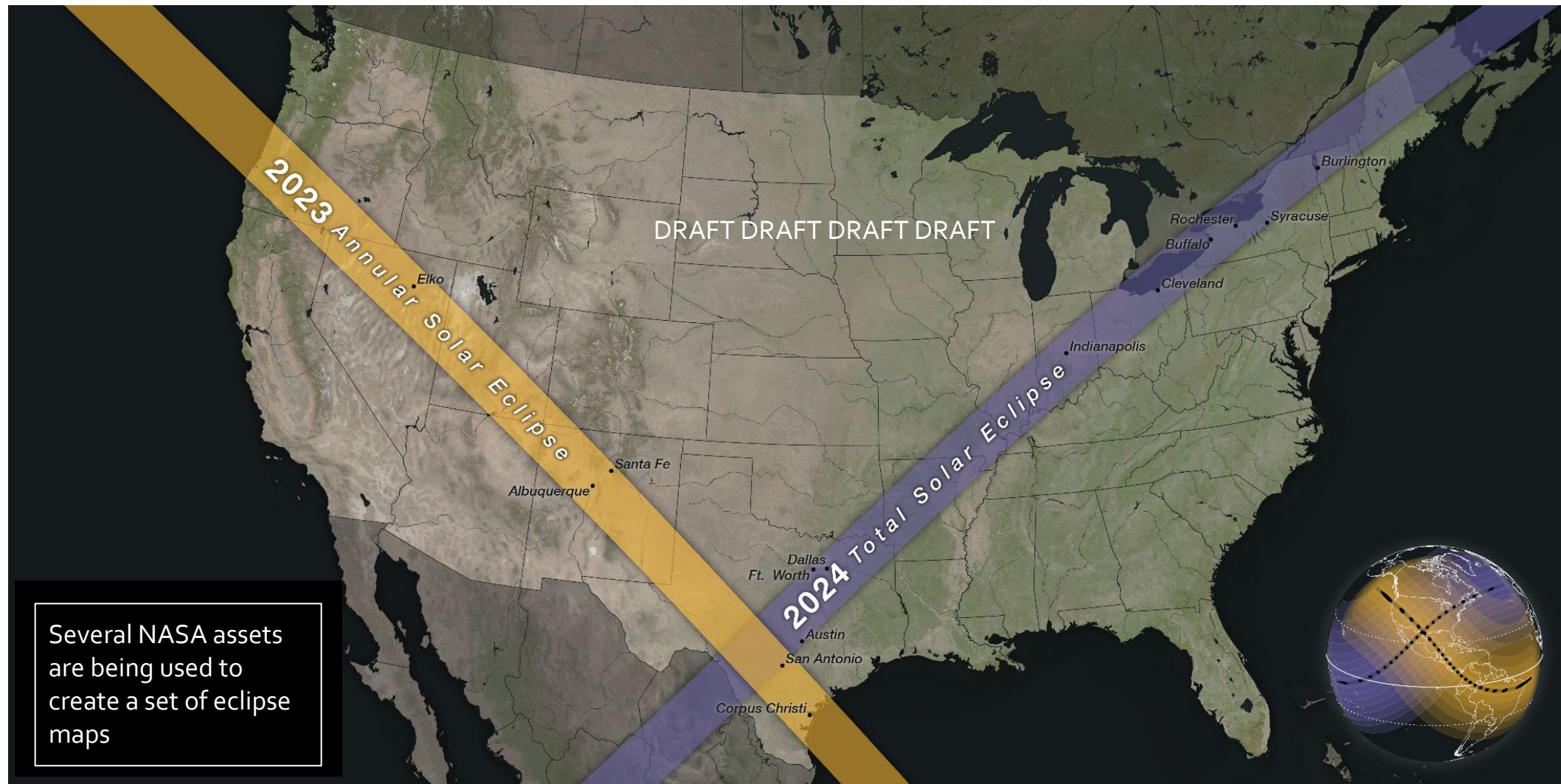
A total eclipse, when the Sun is completely blocked by the Moon, will last up to a few minutes, depending on your location.



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

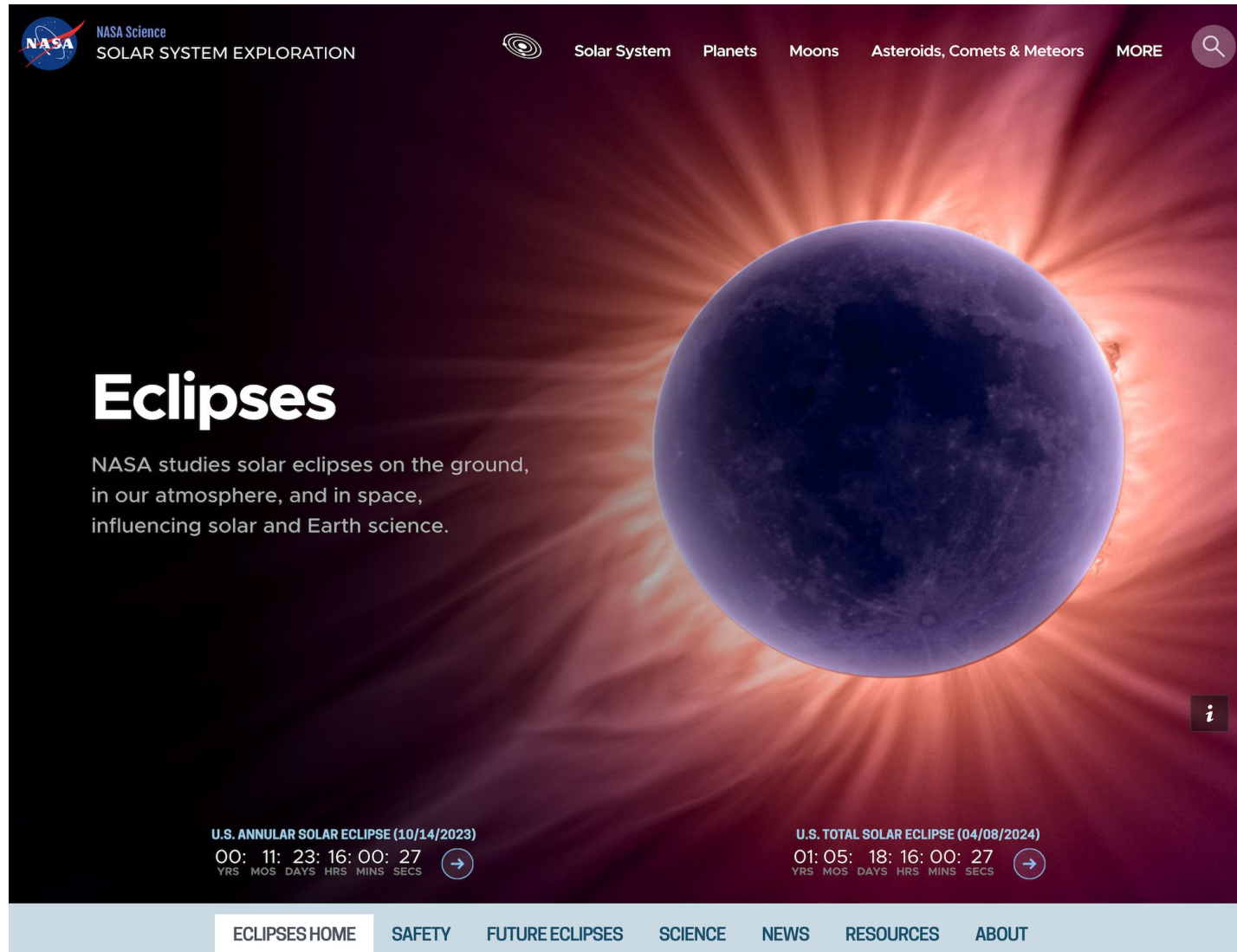
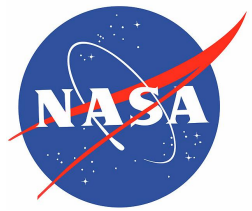


2023 and 2024 Eclipse Paths





New NASA Eclipse Website

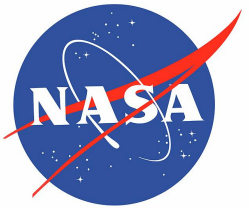


- Phase 1 contains eclipse evergreen content
- Microsites for October 14, 2023 Annular Solar Eclipse and April 8, 2024 Total Solar Eclipse
- Phase 2 GSFC eclipse website modernization

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



NASA Eclipse Trainings



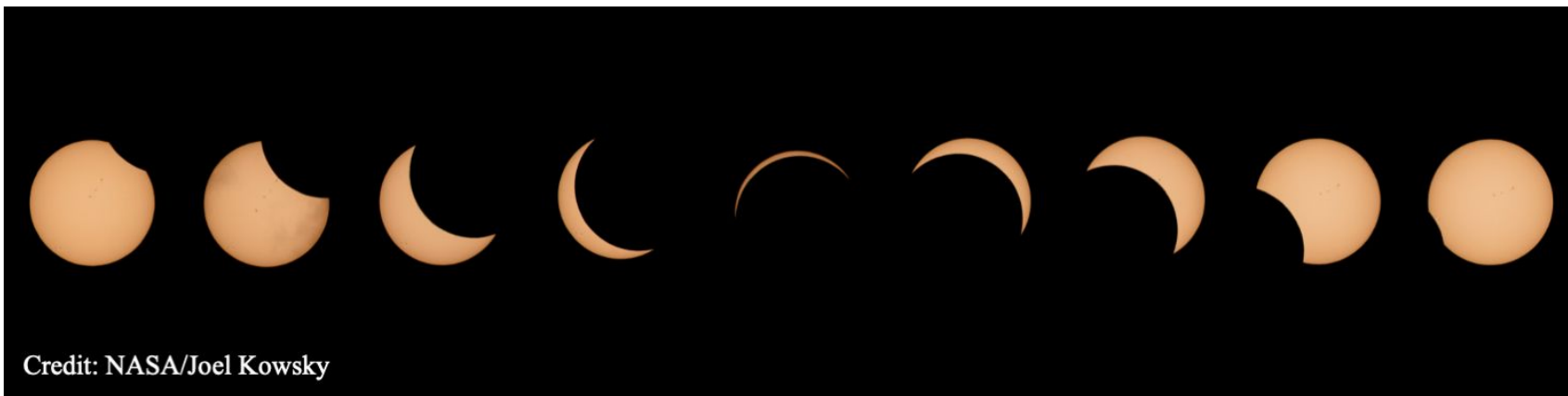
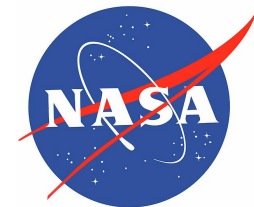
Eclipse Training Materials

NASA HEAT is creating eclipse training materials to educate the NASA community and is making these resources available to all on the <https://solarsystem.nasa.gov/eclipses/>.

- One training will target the 2023 Annular eclipse and the other will focus on the 2024 total solar eclipse.
- NASA HEAT's aim is to provide consistent NASA messaging for the annular eclipse and the total solar eclipse across all NASA centers.
- NASA HEAT's training materials will highlight NASA's priorities for 2023 & 2024.



NASA Updates for Non-NASA Funded Eclipse Enthusiasts



Credit: NASA/Joel Kowsky

- Inspire and educate about the:
 - **Annular eclipse - Saturday, October 14, 2023**
 - **Total solar eclipse - Monday, April 8, 2024**
- Call for all eclipse enthusiasts:
 - Stay informed about NASA's happenings with the solar eclipses
 - Receive quarterly news
- Sign up for more information:
 - Training resources
 - Planning tips
 - Events

For All Eclipse Enthusiasts



bit.ly/3glzgLi

ECLIPSE



THROUGH THE EYES OF NASA



bit.ly/3glzgLi



Citizen Science Project

ECLIPSE
SOUNDSCAPES

Science Questions

Are animal behaviors significantly impacted by solar eclipses, as measured by changes in animal sounds?

What percentage of a solar eclipse (total, 95%, 85%, etc.) is necessary to produce a detect



Citizen Science Project

ECLIPSE
SOUNDSCAPES

MaryKay Severino



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

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

PARTNER undergraduates with amateur astronomers
DISCOVER the best public engagement practices together
INSPIRE underserved communities with eclipse engagement



Partner

ECLIPSE AMBASSADORS

eclipseambassadors.org



500 Communities Eclipse Ambassador Partnerships



Amateur Astronomer

Undergraduate

Training Goals

1,000 Eclipse Ambassadors

Safety



Science



Significance

10+ Virtual Workshops
3 weeks each (1.5 hour/week in-person)
Cultural competency core

Project Goals

**Engage underserved
communities...**

**with effective & equitable
NASA science...**

**to seed lasting community
relationships.**

Timeline & Milestones



We Need You!

- **Join the Project**
Undergraduates and
Amateur Astronomers
- **Spread the Word**
Share with your
communities



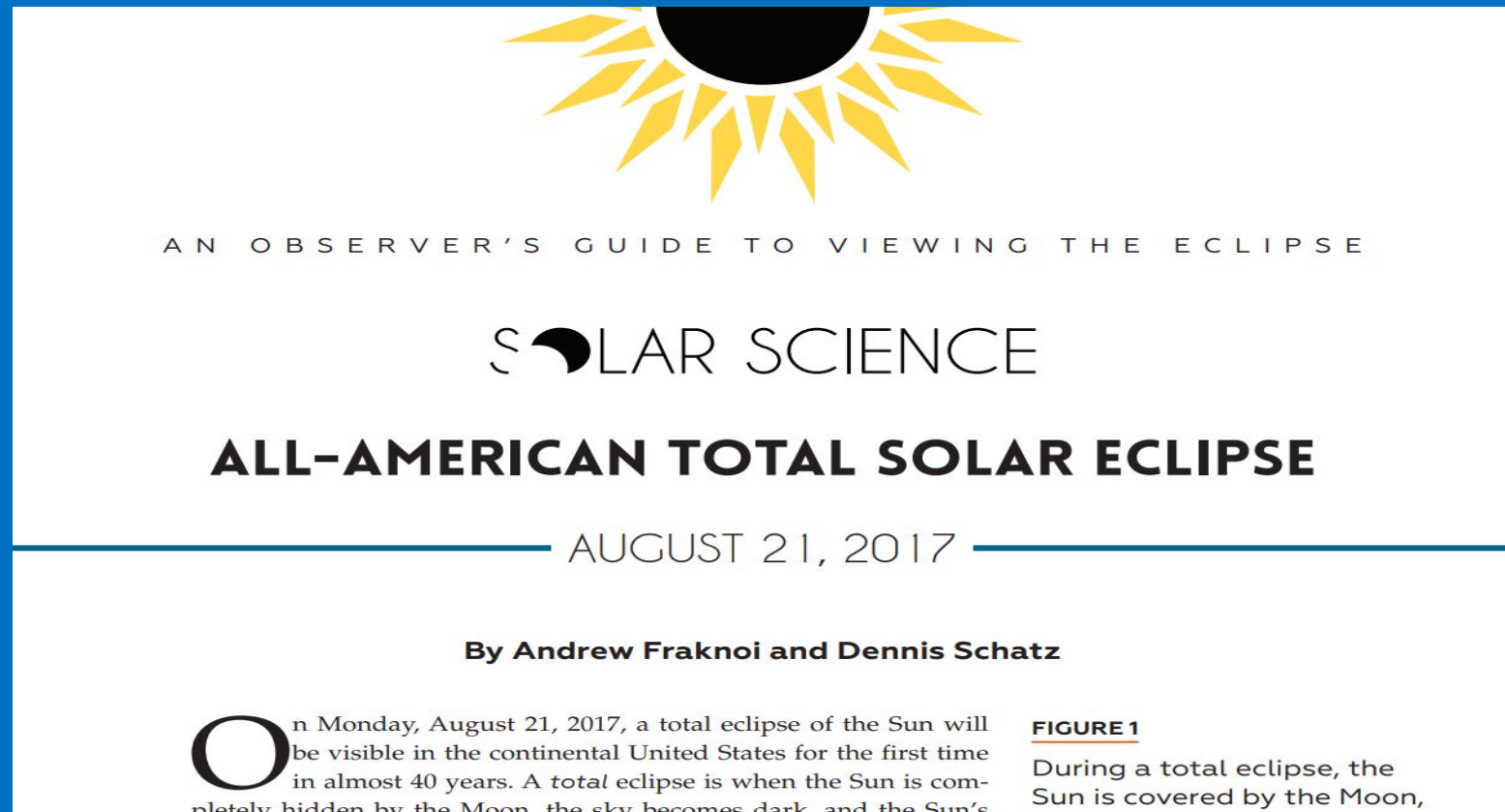
eclipseambassadors.org

Solar Eclipse Resources from NSTA

Transforming science education to benefit all through professional learning, partnerships and advocacy.

NSTA Eclipse Observing Guide

Similar to 2017, NSTA will produce an Eclipse Observing Guide for Educators



Other NSTA Eclipse Resources

- Summer/Fall 2023 issue of NSTA's K-12 Journals dedicated to the eclipses
- Suggestions for how make the eclipses a school and/or community wide event
- Future NSTA webinars
- Materials to share with your administrators

Important Message for Administrators

Look for future resource materials from NSTA that will allow you to inform your school administrators EARLY that:

- Eclipses are a wonderful learning experience
- Eclipses are safe to view
- Safe eclipse-viewing techniques are easy to find and use



SEAL

Solar Eclipse Activities
for Libraries

Solar Eclipse Activities for Libraries

**Andrew Fraknoi,
Dennis Schatz, and Anne Holland**

Lead By



Funded By



2017 Eclipse



- ❑ 2.1 million glasses distributed
- ❑ 6 million people used them
- ❑ 7,100 libraries involved
- ❑ 2,100 librarians took a webinar
- ❑ >35,000 library eclipse programs

2023 and 2024 Eclipses

- ❑ 5 million glasses distributed
- ❑ 10,000 libraries participating
- ❑ Training webinars/workshops for librarian
- ❑ Solar astronomy kits for state libraries to distribute
- ❑ Locating eclipses resource people to help participating libraries
- ❑ Resources for librarians and administrators



The "All-American" Eclipse

A Guide for Public Libraries and Their Communities



by Andrew Fraknoi (Foothill College) and
Dennis Schatz (Pacific Science Center)

2

How to View an Eclipse Safely

It's not the eclipse that is dangerous to observe, it's the Sun! The Sun's visible (and invisible) rays can cause serious damage to the sensitive tissues of the eyes, often without being immediately aware of it! Normally, our common sense protects us from looking directly at the Sun for more than a second. But during an eclipse, astronomical enthusiasm can overwhelm common sense, and people can wind up staring at the Sun for too long. Make sure all attendees have something with them to protect their eyes before the eclipse becomes total – or if they are only seeing the partial eclipse.

Are eclipses of the Sun dangerous to watch?

The few minutes of total eclipse (when the Sun is completely covered) ARE safe, but anytime that even a small piece of the bright Sun shows, your eyes are in danger. Paper glasses with special filters made of protective material will be sold in lots of places. (Make sure that on the back, in small print, they say that they are ISO 12312-2 certified.) Sunglasses are NOT sufficient to protect your eyes!

To summarize: If you are lucky enough to be in the path of the total eclipse, you can and should remove your glasses during the few minutes that the eclipse is total, so you can see in the beauty of the scene. But if you are viewing the partial eclipse only, you must keep your glasses on anytime you are looking in the direction of the Sun.



Three Women With Eclipse Glasses

What are some ways I can watch the eclipse safely when part of the Sun is still visible?

A. Sun Filters to Look Directly at the Sun

To look at the Sun directly, except during the total phase of the eclipse, you need a good filter that can cut out not just its intense light, but also its ultraviolet and infrared waves. Sunglasses or smoked glass are NOT OK! If you have access to welder's supplies (and not many people do), #14 arc-welder's glass is an excellent filter (but it has to be #14 and not lower numbers). Or you can use special black or aluminized polymer filters that are sold as eclipse glasses; but make sure you get them from a reliable source and that they are certified. Companies making and selling them in bulk include:

American Paper Optics:
<http://www.eclipseglasses.com/>

Rainbow Symphony:
<http://www.rainbowsymphony.com/>

Thousand Oaks Optical:
<http://www.thousandoaksoptical.com/>

Ideas for public programs about the eclipse





Connecting with Partners

- NASA
- Amateur Astronomy Clubs
- Park Rangers
- Community Colleges
- University astronomy departments
- Planetariums
- American Astronomical Society Ambassadors
- Girl Scouts



What to Tell Administrators Concerned with Liability

- ❑ Eclipses are a wonderful learning experience
- ❑ Eclipses are safe to view
- ❑ Safe eclipse-viewing techniques are easy to find and use

NSTA Virtual Conference

The Total Solar Eclipse of 2017
Are You and Your Students Ready for
the Sky Event of the Decade?

Saturday, October 15, 2016

10 a.m. – 2 p.m. ET



Andrew
Fraknoi



Dennis
Schatz



Claire
Raftery

http://learningcenter.nsta.org/products/online_courses/VC_161015.asp

x

Similar to 2017, will do workshops
and webinars for librarians, educators
and eclipse resource people



**Look for to Large Crowds at Libraries
on Eclipse Day – And Before**

Solar Eclipse Live Streams

Annular Eclipse: Sat, Oct 14, 2023

Total Solar Eclipse: Monday, April 8, 2024

3 different Streams will be available for your use:

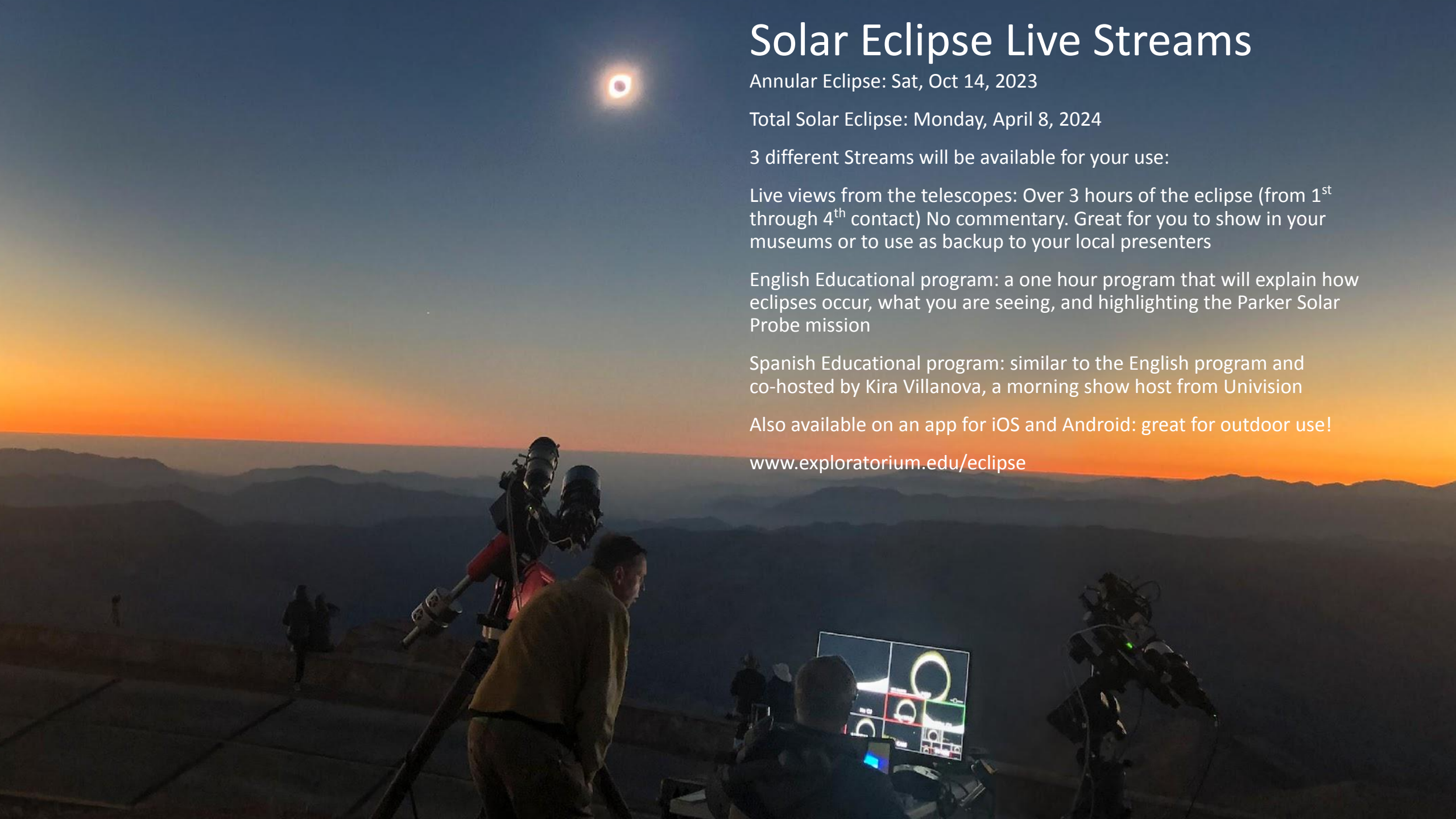
Live views from the telescopes: Over 3 hours of the eclipse (from 1st through 4th contact) No commentary. Great for you to show in your museums or to use as backup to your local presenters

English Educational program: a one hour program that will explain how eclipses occur, what you are seeing, and highlighting the Parker Solar Probe mission

Spanish Educational program: similar to the English program and co-hosted by Kira Villanova, a morning show host from Univision

Also available on an app for iOS and Android: great for outdoor use!

www.exploratorium.edu/eclipse



Thank you to all our presenters!

Get Involved with the NISE Network

Learn more and access the
NISE Network's online digital resources
nisenet.org

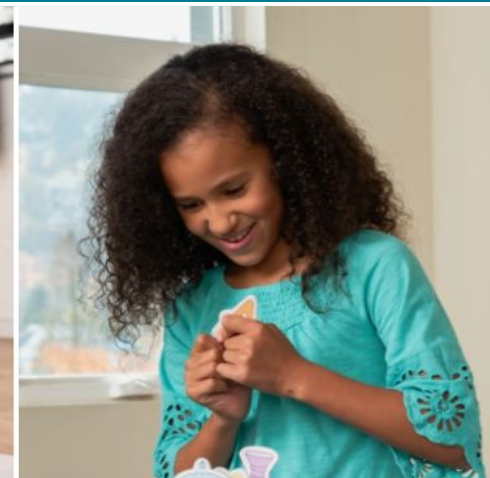


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monthly newsletter**
nisenet.org/newsletter

Follow NISE Net on social networking
nisenet.org/social



Thank You!



This material is based upon work supported by NASA under cooperative agreement award numbers NNX16AC67A and 80NSSC18M0061. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the view of the National Aeronautics and Space Administration (NASA).

Q&A

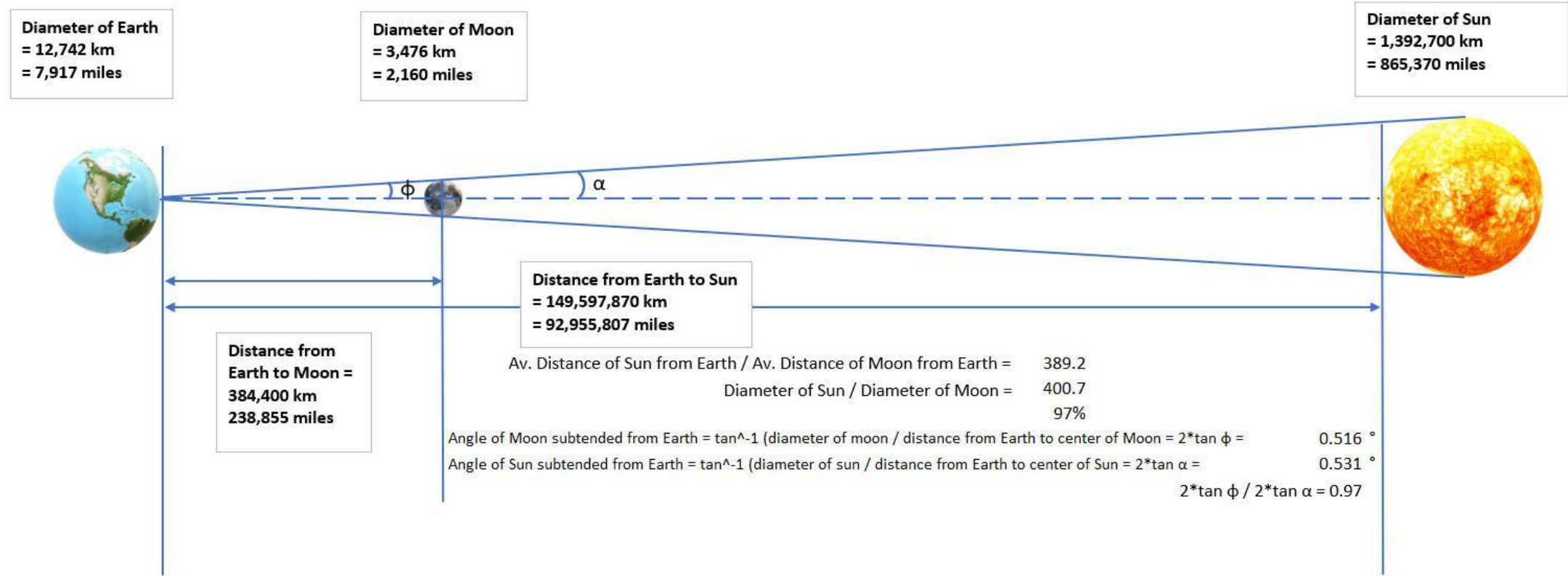
Questions from You!

Many of you asked about...

- **Eclipse Glasses**
 - How to make sure glasses purchased for eclipses are safe
 - Do Solar Eclipse glasses expire?
- **Tips from hosts of events in 2017**
 - Where are the best locations to host an event?
 - How to keep events cost effective
- **Safety** - anything outside of the obvious?
- **Community Engagement** and examples of some of the largest events in 2017
- **Take-home resources** for audiences
- **Backup plan** for cloudy skies?

Why the Sun and Moon appear to be the same size in the Sky

NOT TO SCALE



Angle of Moon subtended from Earth = $\tan^{-1}(\text{diameter of moon} / \text{distance from Earth to center of Moon}) = 2 \cdot \tan \phi = 0.00900$ 0.516 degrees

Angle of Sun subtended from Earth = $\tan^{-1}(\text{diameter of sun} / \text{distance from Earth to center of Sun}) = 2 \cdot \tan \alpha = 0.00927$ 0.531 degrees 0.516/0.531 = 97%

On average, an annular or solar eclipse occurs about once every 1.5 years, and the moon appears to be about 97% of the sun due to variations in the distance of the moon from earth and the angle of its orbit.

On average the Sun appears to be about 0.015 degrees larger than the Moon.

diameter of sun 865,370 miles
radius of sun 432,685 miles
distance to sun 92,955,807 miles

Jim slater307, CC BY-SA 4.0

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