
The 2017 Eclipse:
Tools for Engaging
Young Scientists
8.21.17

The 2017 Eclipse: Tools for Engaging Young Scientists

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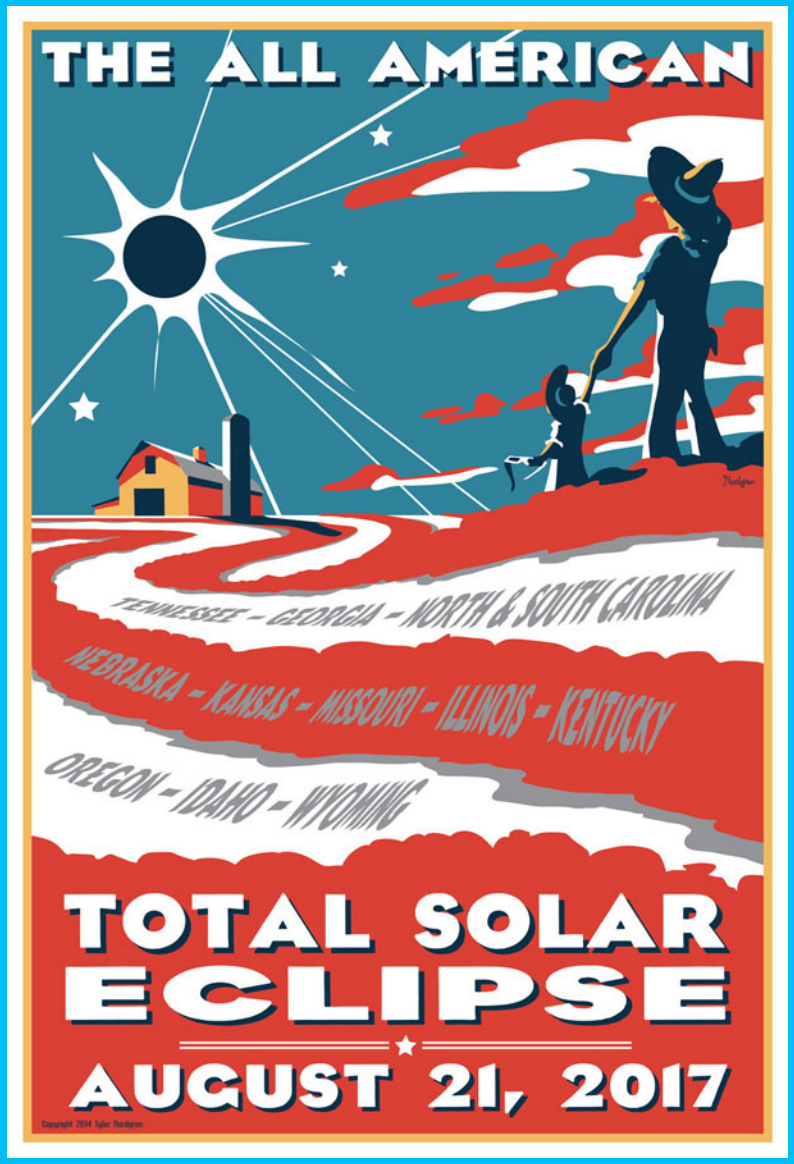
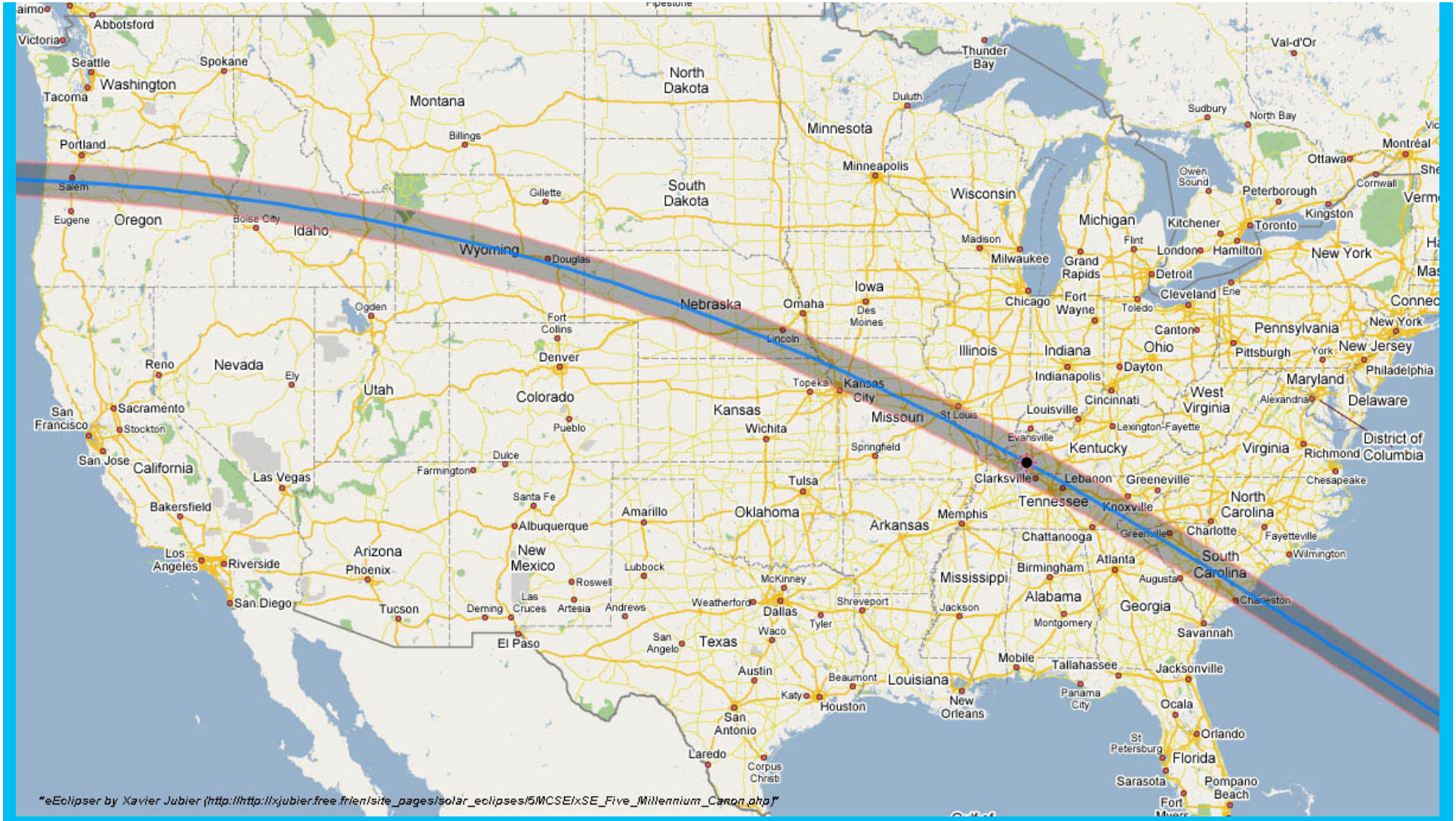
- Darrell Porcello, University of California-Berkeley, porcello@berkeley.edu



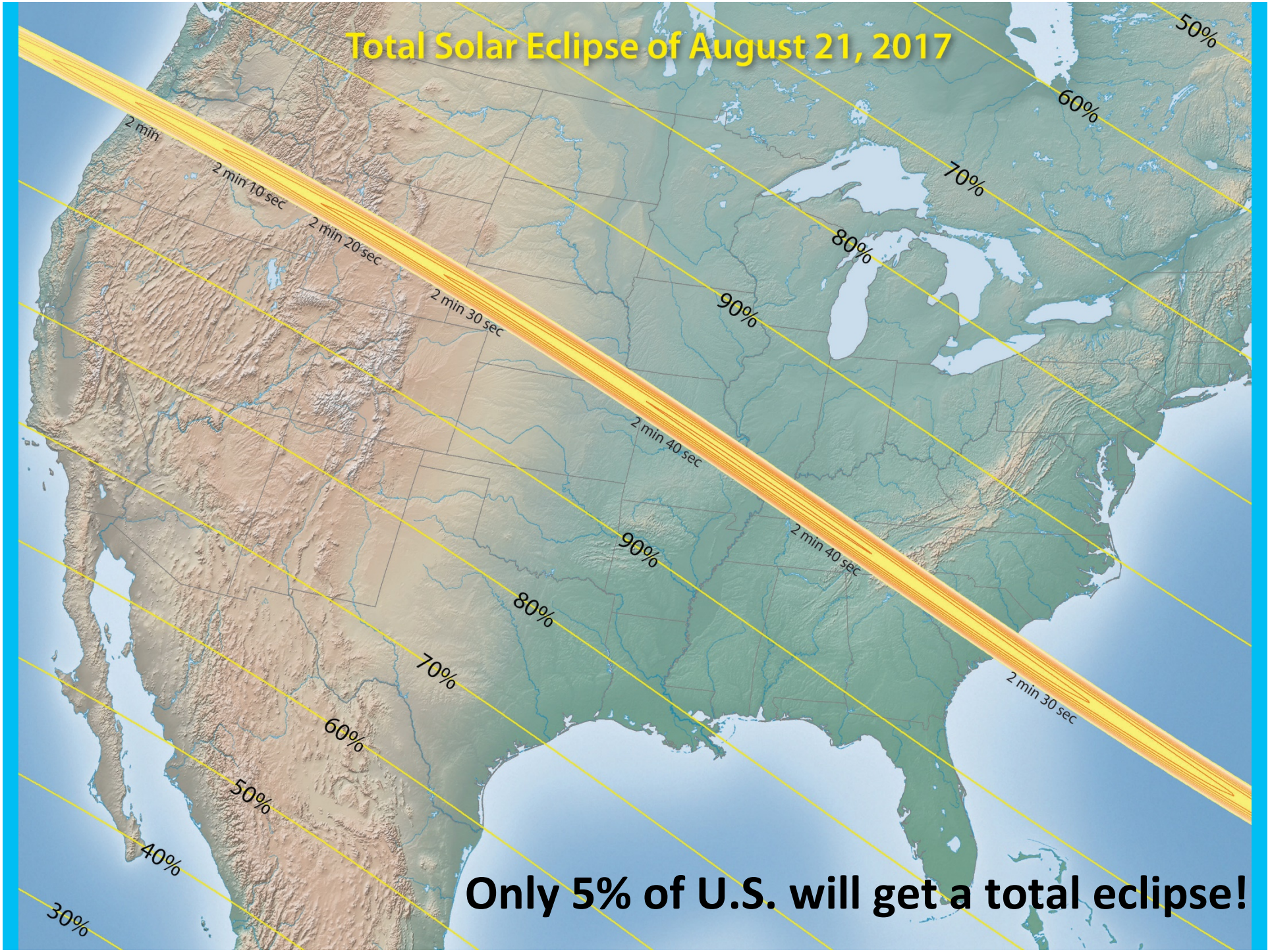
The All American Eclipse



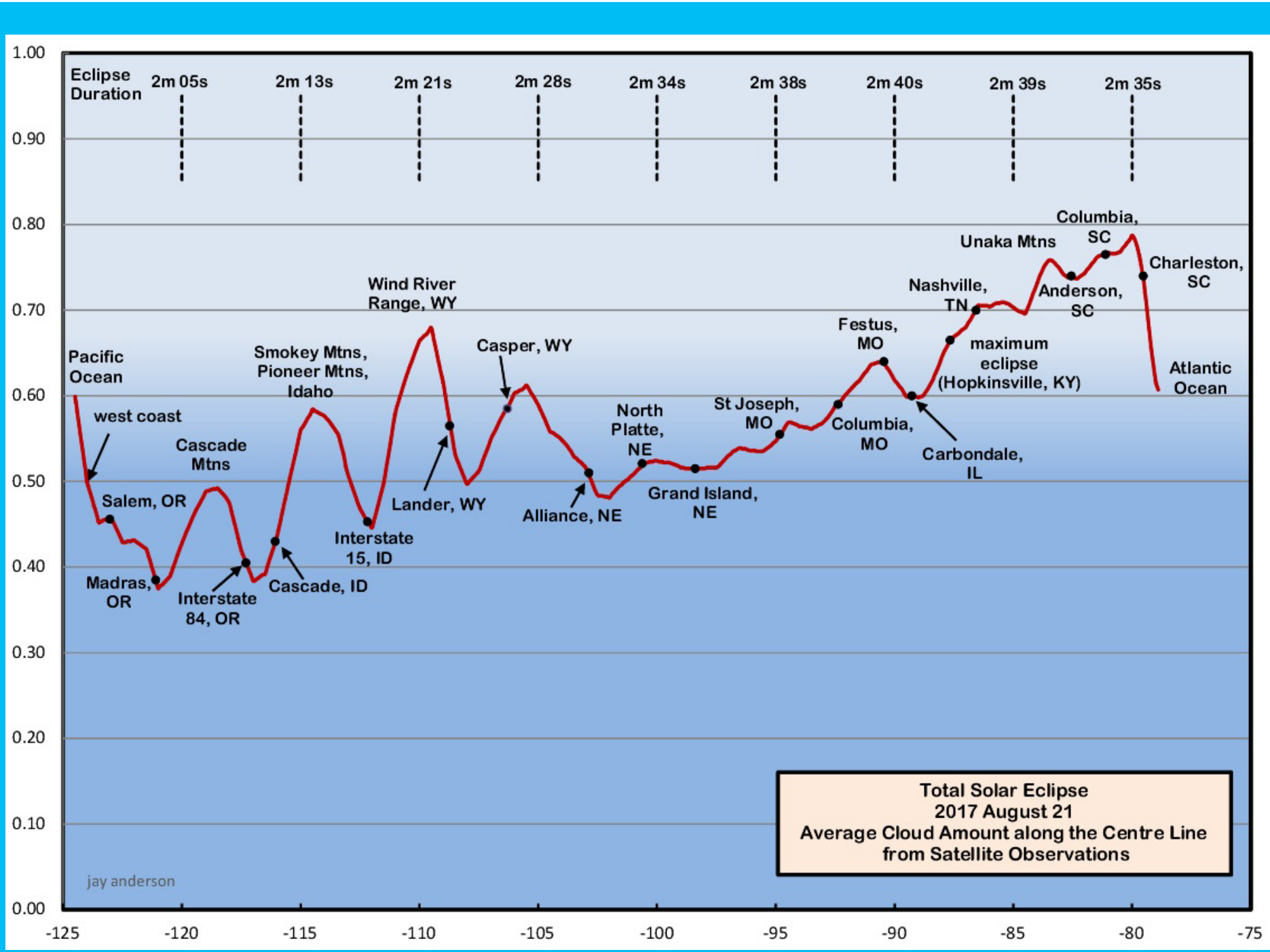
Along Path of Totality = 12 Million
United States = 319 million
Mexico and Canada = 154 million
Total in North America = 473 million

Imagine the number of eclipse glasses that will be sold

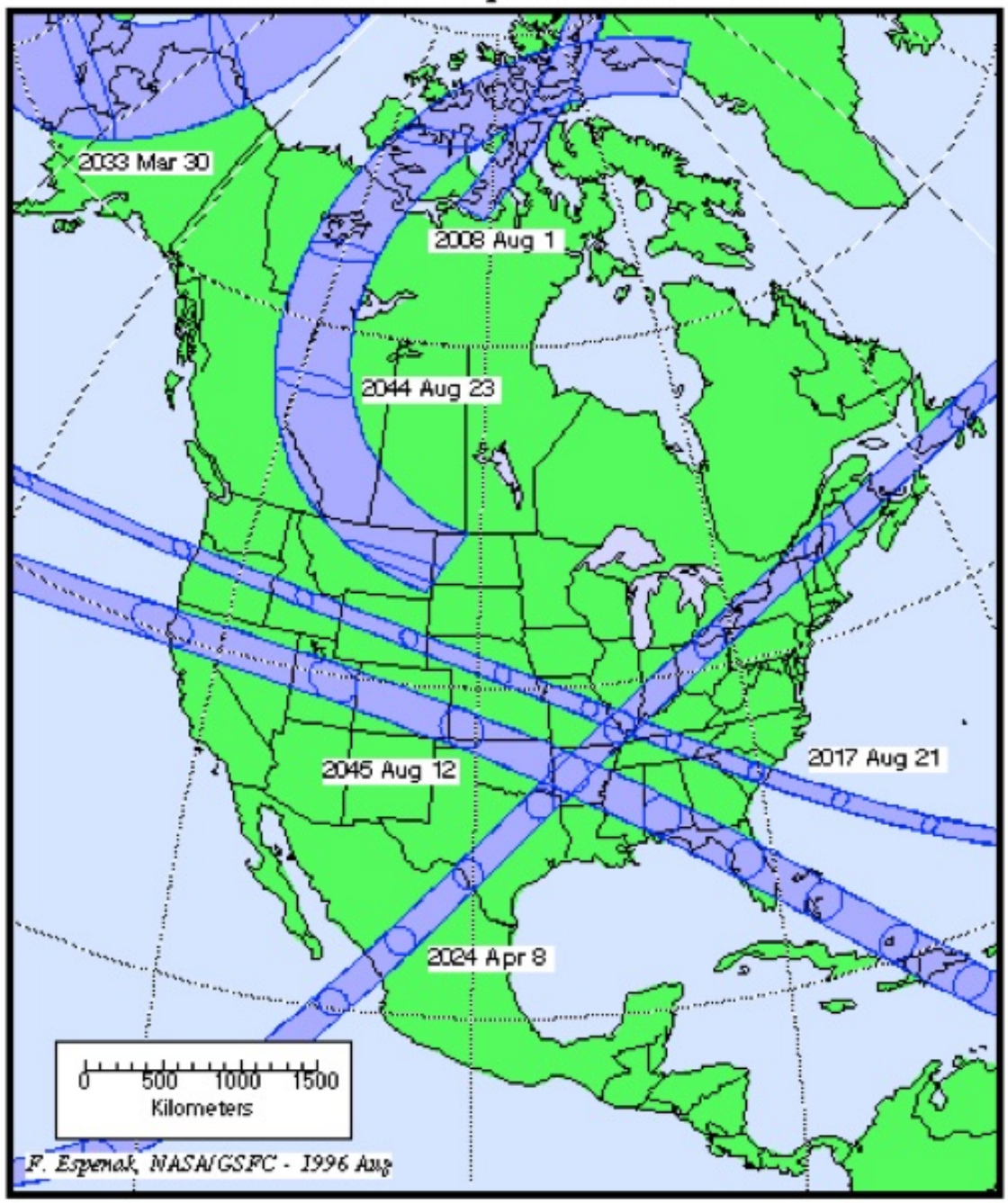

CHRIS COOK PHOTOGRAPHY


Total Solar Eclipse of August 21, 2017
2 min
2 min 10 sec
2 min 20 sec
2 min 30 sec
2 min 40 sec
2 min 40 sec
2 min 30 sec
50%
60%
70%
80%
90%
90%
80%
70%
60%
50%
40%
30%
Only 5% of U.S. will get a total eclipse!


© 2010 American Border Patrol

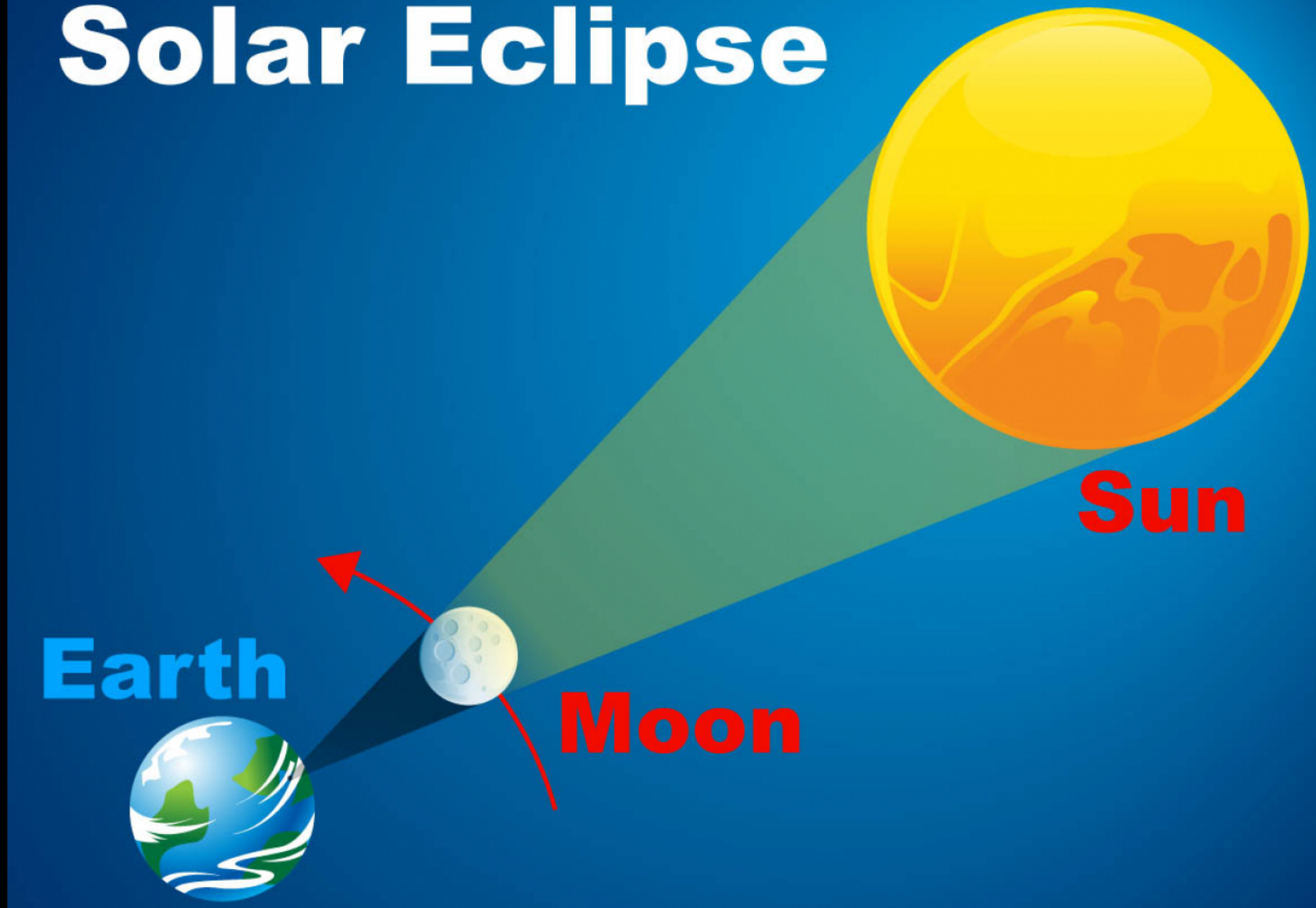

Eclipse Duration
2m 05s
2m 13s
2m 21s
2m 28s
2m 34s
2m 38s
2m 40s
2m 39s
2m 35s
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-125
-120
-115
-110
-105
-100
-95
-90
-85
-80
-75
Pacific Ocean
west coast
Salem, OR
Madras, OR
Cascade Mtns
Interstate 84, OR
Smokey Mtns, Pioneer Mtns, Idaho
Cascade, ID
Interstate 15, ID
Wind River Range, WY
Lander, WY
Casper, WY
Alliance, NE
North Platte, NE
Grand Island, NE
St Joseph, MO
Festus, MO
Columbia, MO
maximum eclipse (Hopkinsville, KY)
Carbondale, IL
Nashville, TN
Unaka Mtns
Anderson, SC
Columbia, SC
Charleston, SC
Atlantic Ocean
Total Solar Eclipse
2017 August 21
Average Cloud Amount along the Centre Line
from Satellite Observations
jay anderson

Total Solar Eclipses: 2001 - 2050




www.AstroPixels.com
©2012 F. Espenak

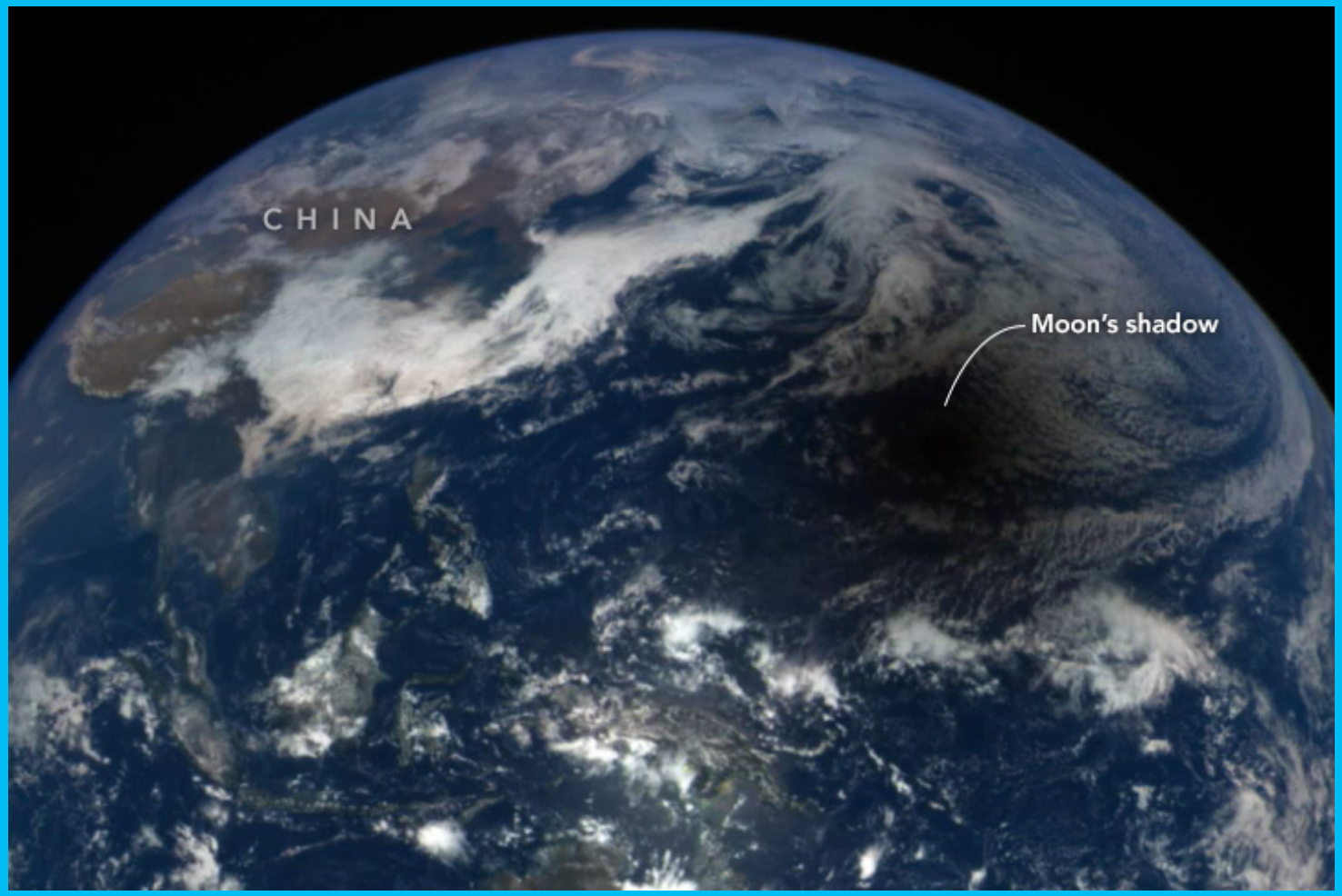
Solar Eclipse



Questions That Immediately Come Up

- If a full Moon and new Moon happen every month, shouldn't we have eclipses every month?
- Why is the 2017 total solar eclipse the first one in the US in almost 40 years?
- Why do people spend thousands of dollars and travel thousands of miles to see a solar eclipse, but don't travel to see a lunar eclipse?

Hula Hoops Provide the Answer

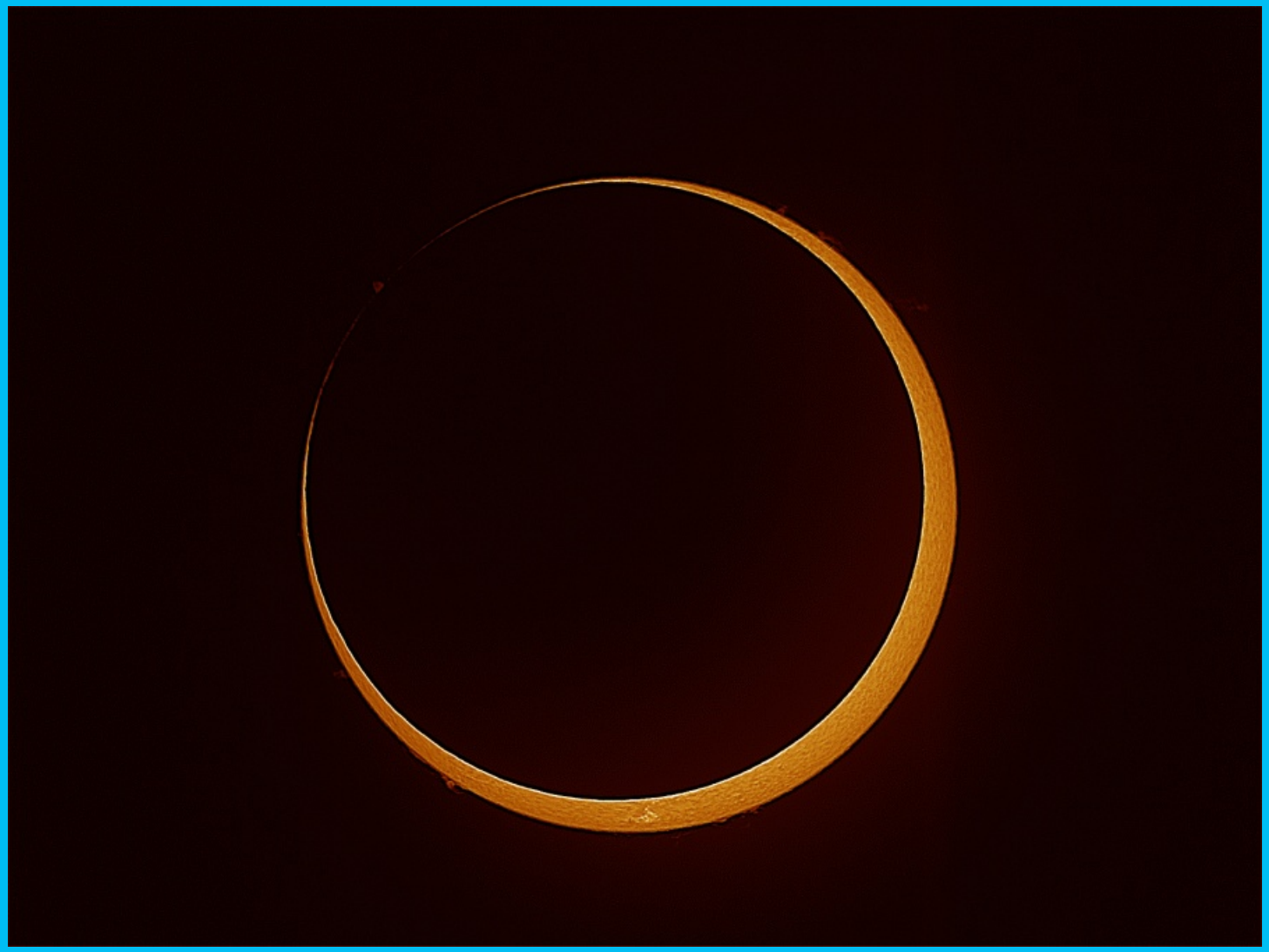


The eclipse shadow moves across the U.S. at 3900 kph (2400 mph).

Crosses the state of Oregon in 9 minutes!

It will take 1 hour and 37 minutes to cross the U.S.


CHRIS COOK PHOTOGRAPHY



AN OBSERVER'S GUIDE TO VIEWING THE ECLIPSE

SOLAR SCIENCE

ALL-AMERICAN TOTAL SOLAR ECLIPSE

AUGUST 21, 2017

By Andrew Fraknoi and Dennis Schatz

On Monday, August 21, 2017, a total eclipse of the Sun will be visible in the continental United States for the first time in almost 40 years. A *total* eclipse is when the Sun is completely hidden by the Moon, the sky becomes dark, and the Sun's faint atmosphere (*corona*) becomes visible—looking like a beautiful halo (Figure 1). This total eclipse will *only* be visible on a narrow track stretching across the United States from Oregon to South Carolina. No other country will get to see the total eclipse this time.

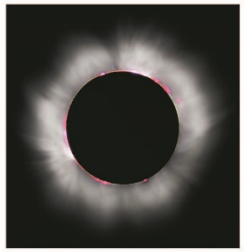
The rest of the United States and other parts of North and Central America will see a *partial* eclipse, in which the Moon covers only a portion of the Sun. A partial eclipse is interesting, but nowhere near as awe-inspiring and memorable as a total eclipse. A partial eclipse is also dangerous to look at without something to protect your eyes from the Sun's damaging rays.

What Exactly Is a Total Eclipse of the Sun?

A total eclipse of the Sun occurs when the Moon gets between the Sun and the Earth and covers up the Sun. It just so happens that the Moon, as seen from Earth, and the Sun, as seen from Earth, are the same size in the sky. So if the two are exactly lined up, the Moon can hide the Sun from our sight. This allows us to see the Sun's corona,

FIGURE 1

During a total eclipse, the Sun is covered by the Moon, and the faint light of its corona becomes visible.



Source: Luc Viatour, Wikimedia Commons, CC BY-SA 3.0. https://en.wikipedia.org/wiki/File:Solar_eclipse_1999_4_NR.jpg

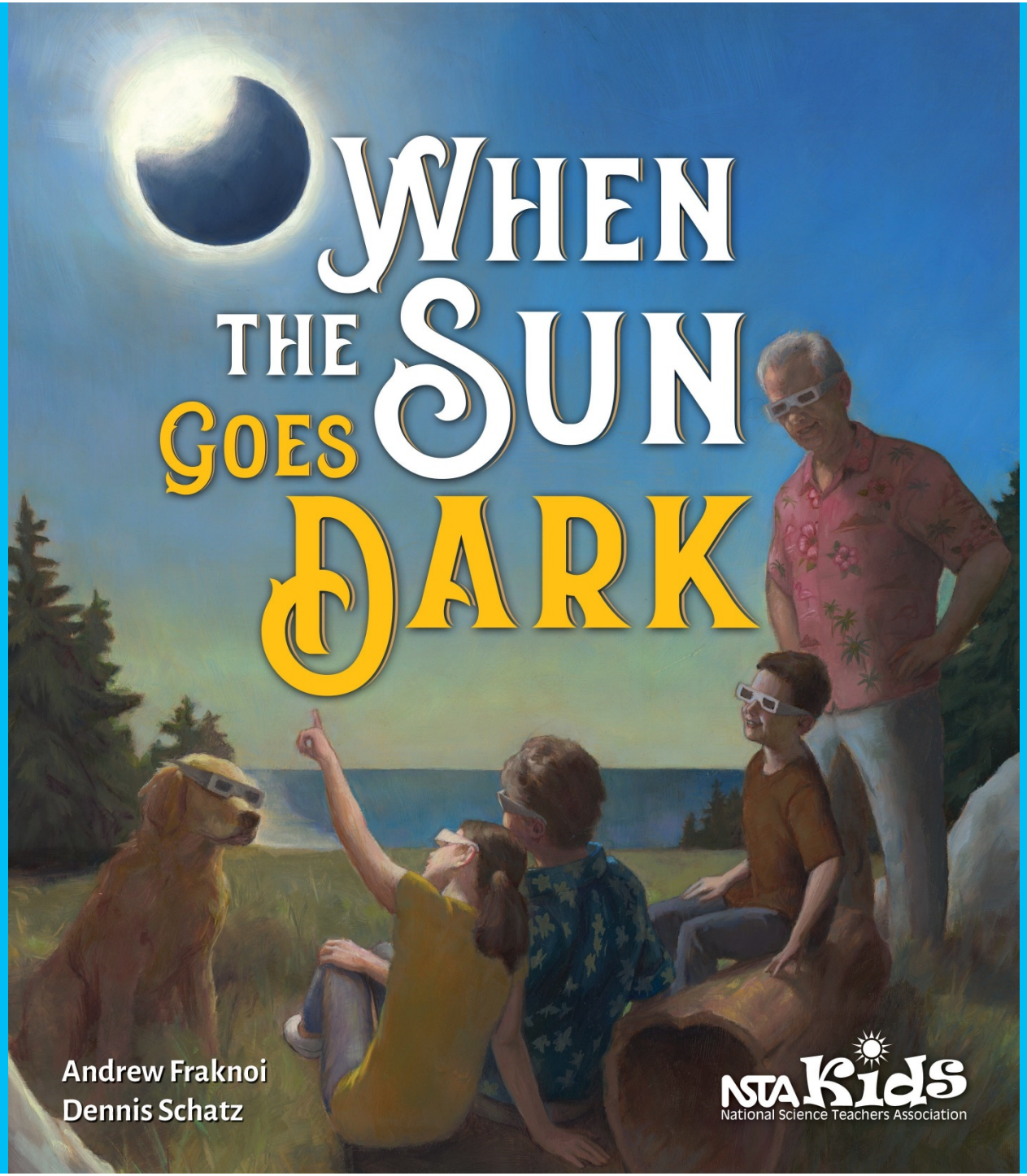
NSTA National Science Teachers Association

For free distribution by NSTA

An 8-page summary of the booklet in *Solar Science:*

http://bit.ly/2bkGSvA or www.nsta.org/solarscience


SOLAR SCIENCE
EXPLORING SUNSPOTS, SEASONS, ECLIPSES, AND MORE
Dennis Schatz
Andrew Fraknoi
NSTApress
National Science Teachers Association


When the Sun Goes Dark
Andrew Fraknoi
Dennis Schatz
NSTA Kids
National Science Teachers Association

Next, Grandpa did this odd thing where he held both hoops around his head at the same time, but they weren't lined up. The purple one was above the yellow one on one side and below it on the other side, and they only touched in two places.

Grandpa told us that's what happens with the paths of the real Moon and Sun in the sky. The Moon is usually above or below the Sun by a small amount. If they are not lined up exactly, the Moon can't pass directly in front of the Sun, and there won't be an eclipse.

"How often do the Hula-Hoops cross?" Grandpa asked me and my brother.

We both said, "Twice" at the same time, which made all four of us laugh.

"What do you think happens when the Moon and Sun arrive together at one of the two places where the Hula-Hoops cross?" Grandpa asked us.

jus
can happe
said, "Eclipses," an
Grandpa then t
and the Moon arriv
only twice a year.
season' roughly ev
of the Sun and the
Earth."

I had to think
was the first tim
mentioned that t
too. I wanted to a
two times a year st
So I asked Grandp
to see an eclipse o
a year.


Total Solar Eclipse

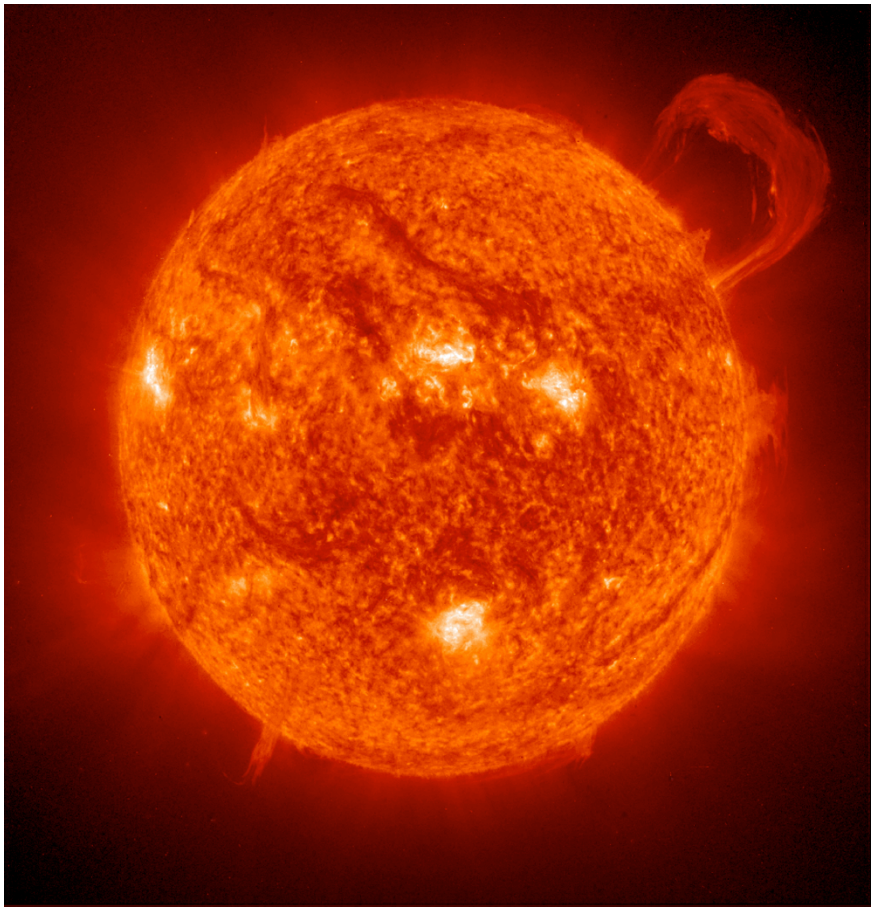

Total Solar Eclipse


Track of the Total Solar Eclipse Across the United States
August 21, 2017
Salem, OR
Idaho Falls, ID
Casper, WY
Lincoln, NE
St. Louis, MO
Kansas City, KS
Nashville, TN
Charleston, SC


I wish you clear skies and
safe viewing
on August 21!

Eclipses are SAFE!

The Sun is not.



Safety

Car Safety

Planning to Drive the Eclipse

https://www.ready.gov/car

Camping Health and Safety

https://www.cdc.gov/family/camping/

http://www.recreation.gov/recFacilityActivitiesHomeAction.do?goto=camping.htm&activities=9

Heat and Children in Cars

http://www.safercar.gov/parents/InandAroundtheCar/heatstroke.htm

http://www.safercar.gov/parents/InandAroundtheCar/heat-involved.html

Federal Emergency Management Agency – Are You Ready

Food and Water Safety

Hazards to Outdoors Workers

Heat and Hydration

Hiking Safety

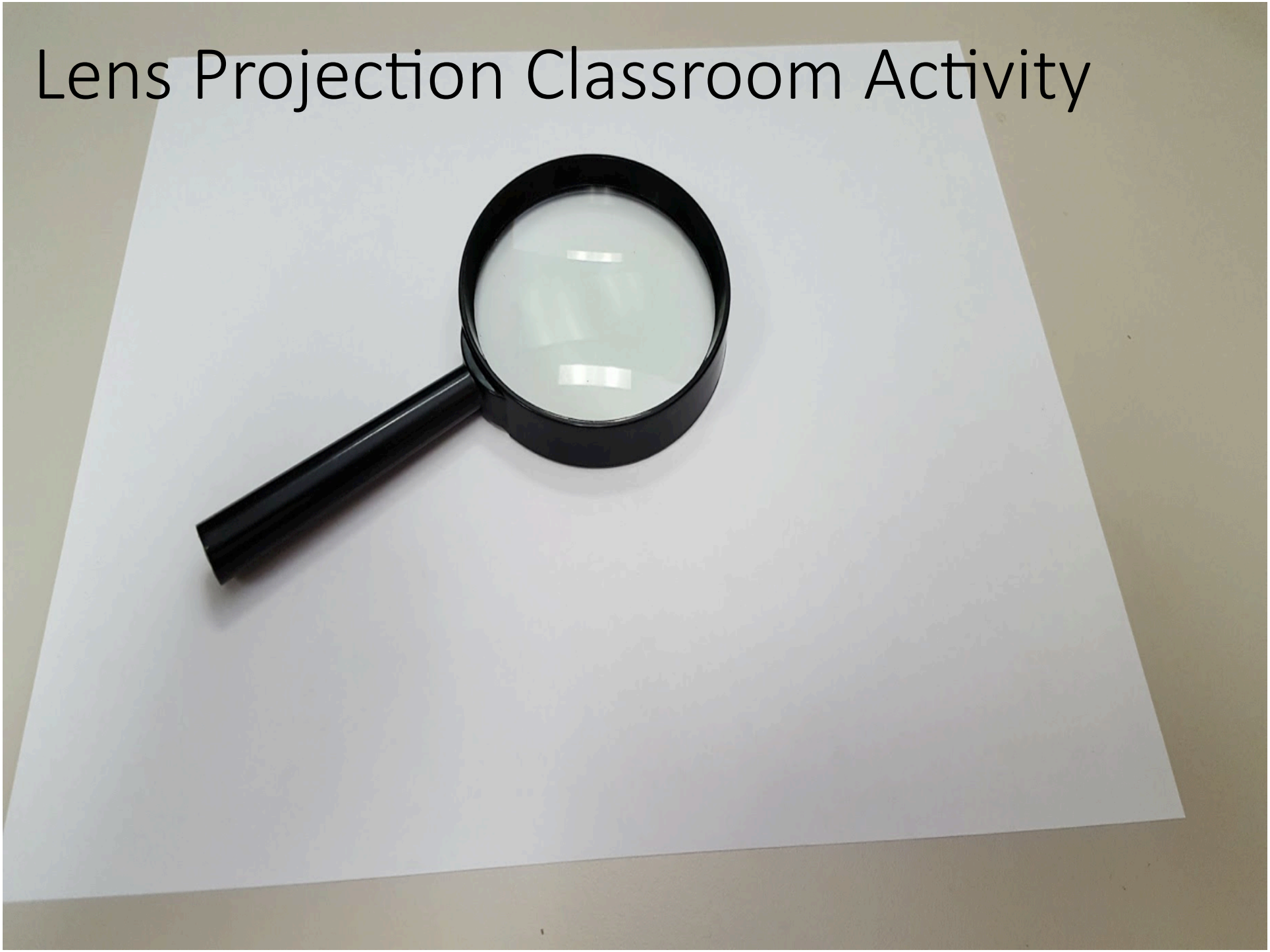
Large Crowds Safety

Personal Safety – At Home, On the Street, While Traveling

Sun Safety: Save Your Skin

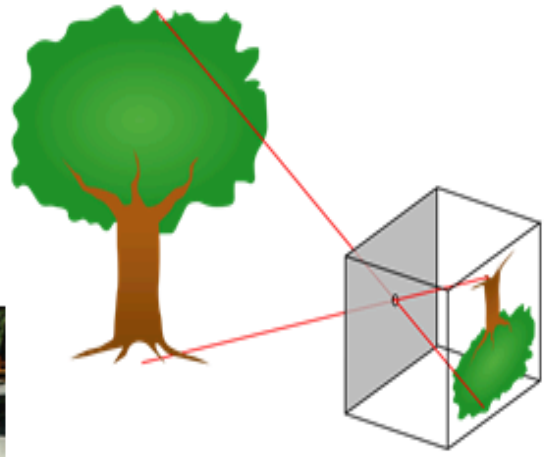
https://eclipse2017.nasa.gov/safety

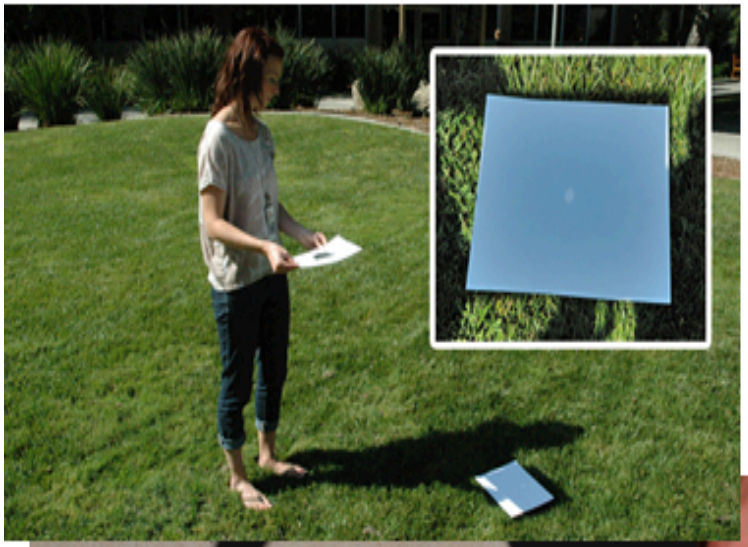
Lens Projection Classroom Activity

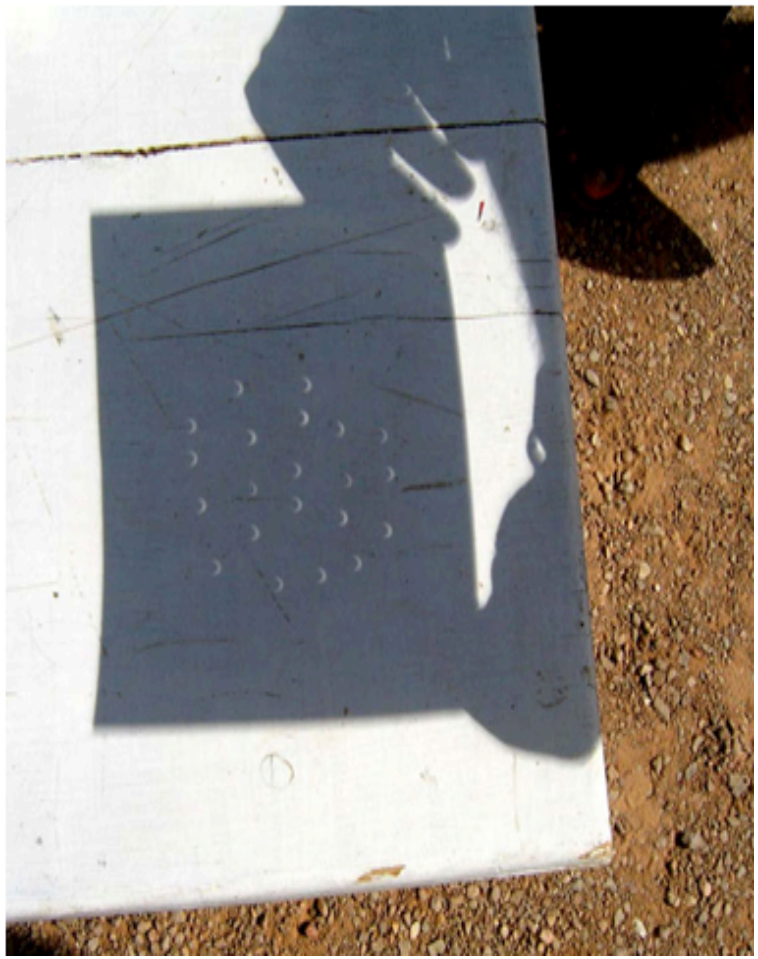




Pinhole Projection

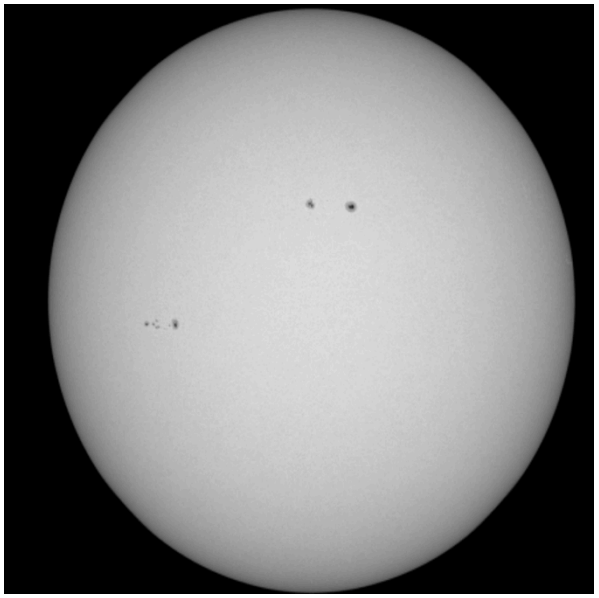






Mirror projection



Safety

Car Safety

Planning to Drive the Eclipse

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Large Crowds Safety

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Sun Safety: Save Your Skin

https://eclipse2017.nasa.gov/safety

The Solar Eclipse for Early Learners

Anna Hurst, Astronomical Society of the Pacific, ahurst@astrosociety.org

Ellen Blinderman, Lawrence Hall of Science, ellenb@berkeley.edu

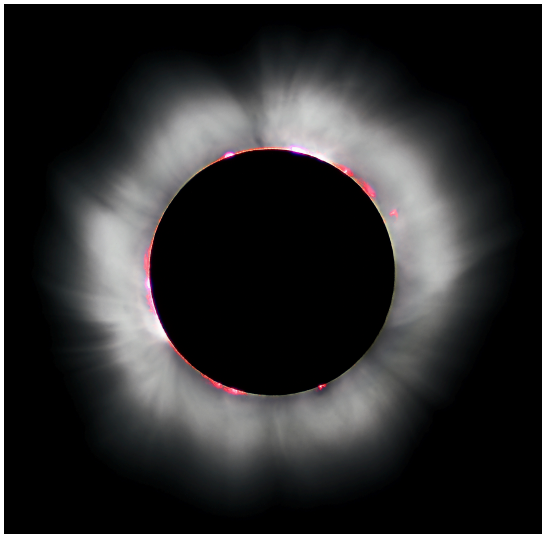
With resources from:
Alice Enevoldsen, Alice's Astro Info (Seattle), alicesastroinfo@gmail.com

My Sky Tonight

www.astrosociety.org/MySkyTonight

Before the Eclipse

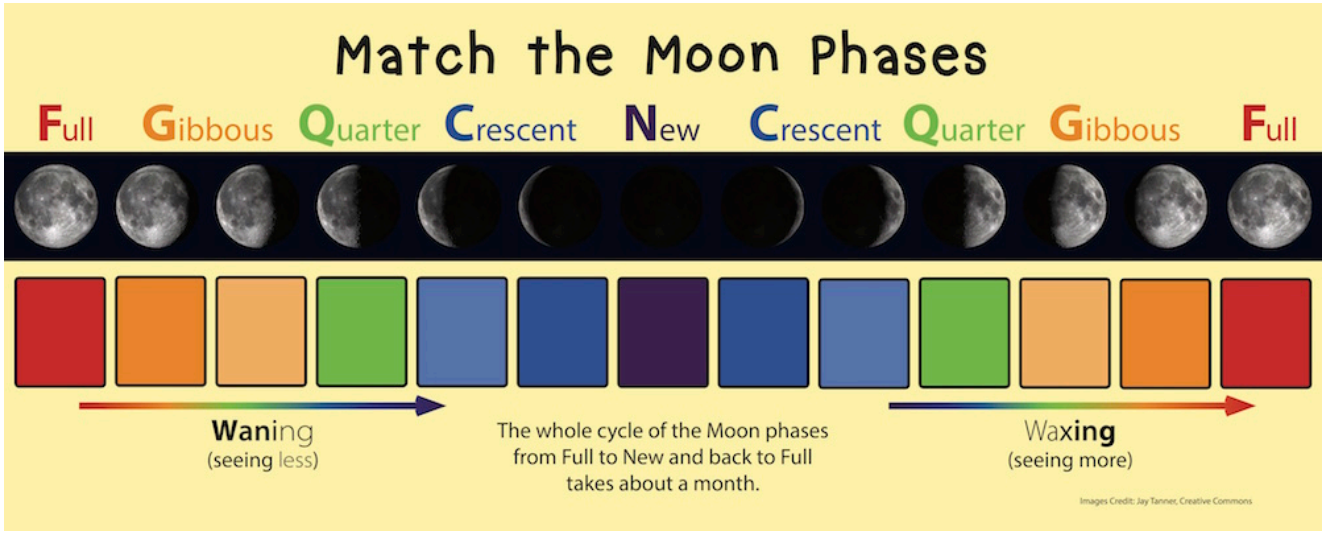
- Stepping stone activities
- Images of solar eclipse
- Model of solar eclipse
- Practice safe solar observing



Activity: Bear's Shadow

Activity: Bear's Shadow

Activity: Moon Phases Matching



Model the Eclipse

Solar Viewing Safety - PreK & K

- Enlist adults
  - Aim to have 1:2 or 1:3 ratio of adults to kids, caregivers count!
- Simple rules - just two or three, positive statements, e.g.:
  - Always use a filter to look at the Sun
  - Clasp your hands together when using a telescope
- Add a band to glasses
- Avoid pointing at the Sun, unless everyone is wearing filters
- Use indirect viewing for groups
- Model safety: do it with your body/their body
- Practice!

Credit: Alice Enevoldsen, Alice's Astro Info

Credit: Alice Enevoldsen, Alice’s Astro Info

Credit: Alice Enevoldsen, Alice’s Astro Info

Sunspotter

Eclipse Day!

<u>During the eclipse:</u>

- Make sure you have enough adults (1:3 or 1:4)
- Ask questions:
  - *Do you notice anything different about the Sun yet?*
  - *What is covering the Sun?*
  - *Is the Sun completely dark?*
  - *Is there any light at all around the Moon?*

<u>After the eclipse:</u>

- Draw your observations

My Sky Tonight

Free Webinar:

Experiencing the Solar Eclipse with Young Children

Tuesday, May 16 at 1pm PT / 4pm ET

- **Dr. Julia Plummer**, Astronomer & Science Educator, Penn State University
- **Alice Enevoldsen**, Astronomy Educator & Solar System Ambassador, Seattle
- **Anna Hurst**, Director of Museum, Park, & Library Programs, Astronomical Society of the Pacific

www.astrosociety.org/MySkyTonight

NISE
NATIONAL INFORMAL STEM EDUCATION NETWORK

EXPLORE SCIENCE
Earth & Space

2017 Solar Eclipse Planning Mini-kit

Downloadable activities:
Exploring the Solar System: Big Sun, Big Moon
Exploring the Solar System: Solar Eclipse

- **English and Spanish activity versions**
- **Training and content videos for staff and volunteers**
- **Print-out postcards and posters**
- **Event guide for 2017 solar eclipse**

NISE Net activities

EXPLORING THE SOLAR SYSTEM

Solar Eclipse

Try this!

1

On a sunny day, you can make a model of an eclipse outside!

Tip: You can also do this activity in a dim room, using a flashlight (instead of the Sun) as your light source.

2

Hold the toy Moon and take two big steps back from the Earth ball. Position the Moon in between the light source and the big globe. Line up the Moon so it casts a shadow on the Earth.

3

Look carefully at the shadow. Are all parts of it equally dark? Does it cover the whole Earth?

Now try making the Moon's shadow move across the Earth. You're making a model of the path of a solar eclipse! During a real eclipse, what do you think people see when they look toward the Sun?

EXPLORE SCIENCE

EXPLORING THE SOLAR SYSTEM

Big Sun, Small Moon

Try this!

1

A tennis ball and a beach ball are different sizes. Can you make them *appear* to be the same size?

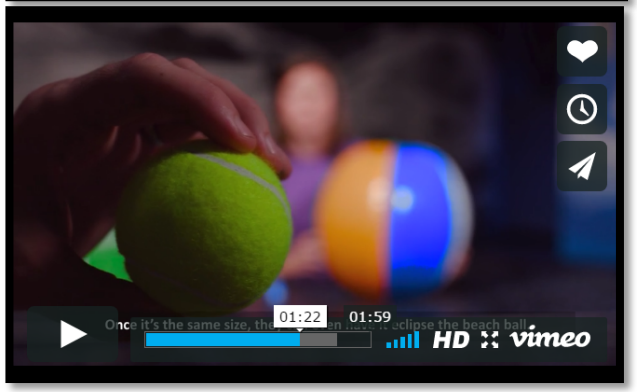
2

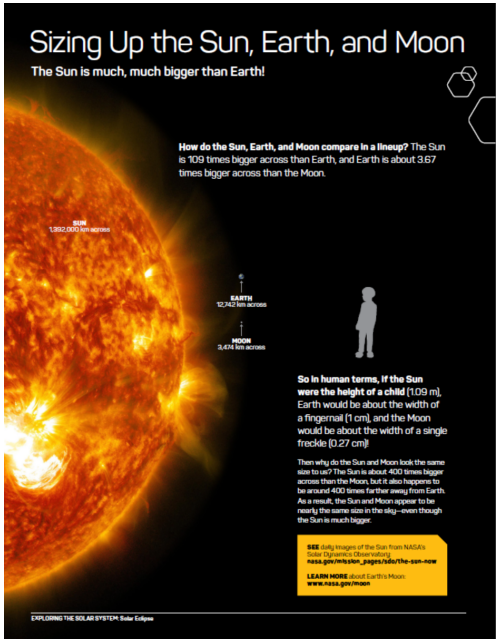
Hand the beach ball to a friend. What happens to the *apparent size* of the beach ball if your friend walks away?

3

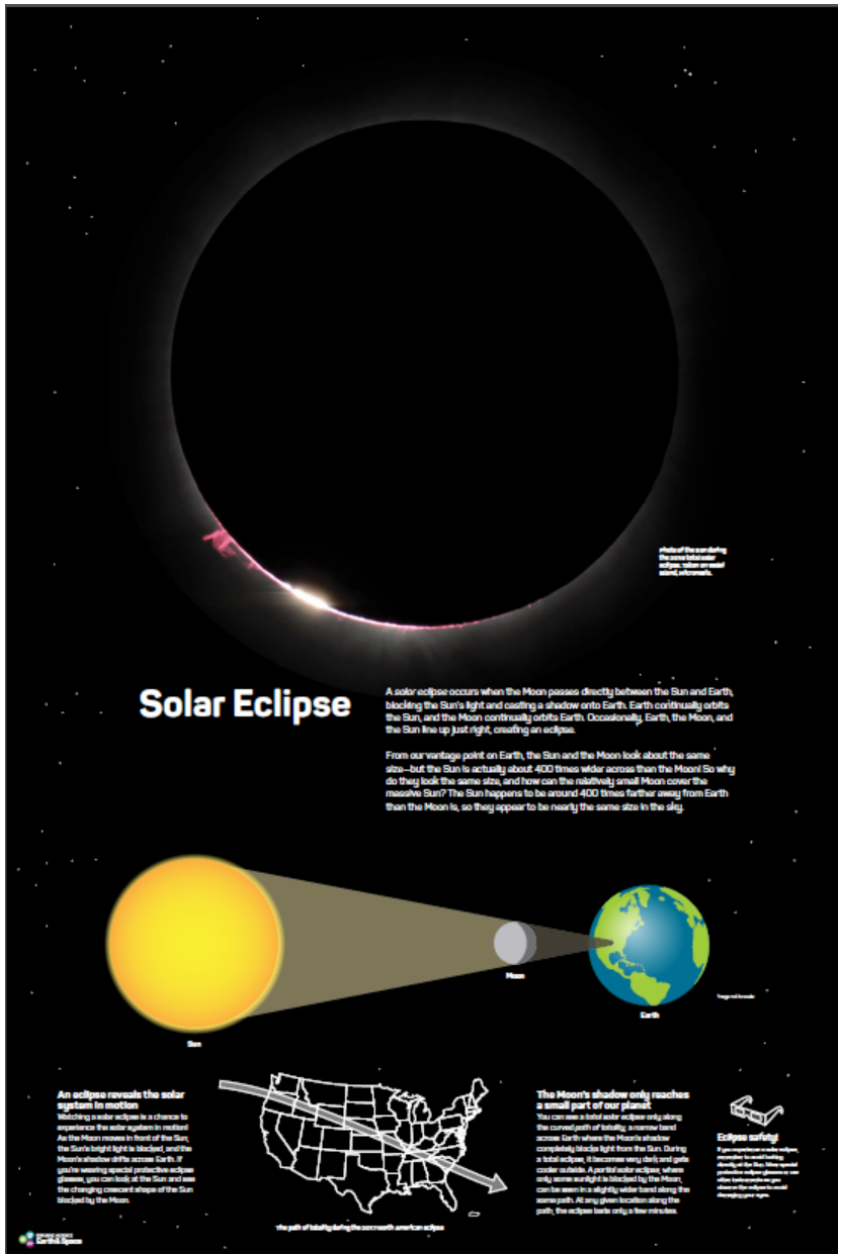
Now, hold up the tennis ball. Can you make the tennis ball and the beach ball appear to be the same size? How far apart are you and your friend?

EXPLORE SCIENCE





NISE Net media



eclipse poster

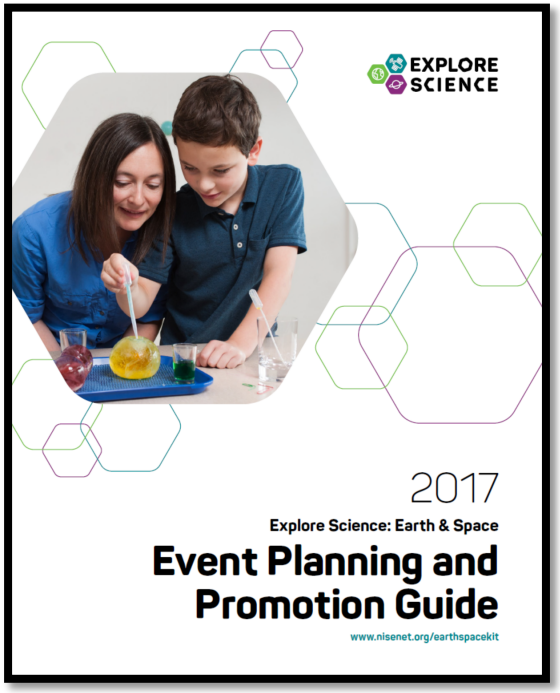
pinhole postcard

background content video

Event resources

Night Sky Network Preparing for the Eclipse Slideshow

- Good intro for leaders, staff, & volunteers
- Safe viewing techniques
- Eclipse background



Planning an August 21, 2017, Solar Eclipse Event (pg. 13-16)

- What Is a Solar Eclipse?
- Planning Ahead
- Safety
- Live Streaming Feeds of the Eclipse
- How to Display Live Feeds
- Press and Marketing Materials for Your Eclipse Event
- Submit Your Event to NASA's Eclipse Website

Required:

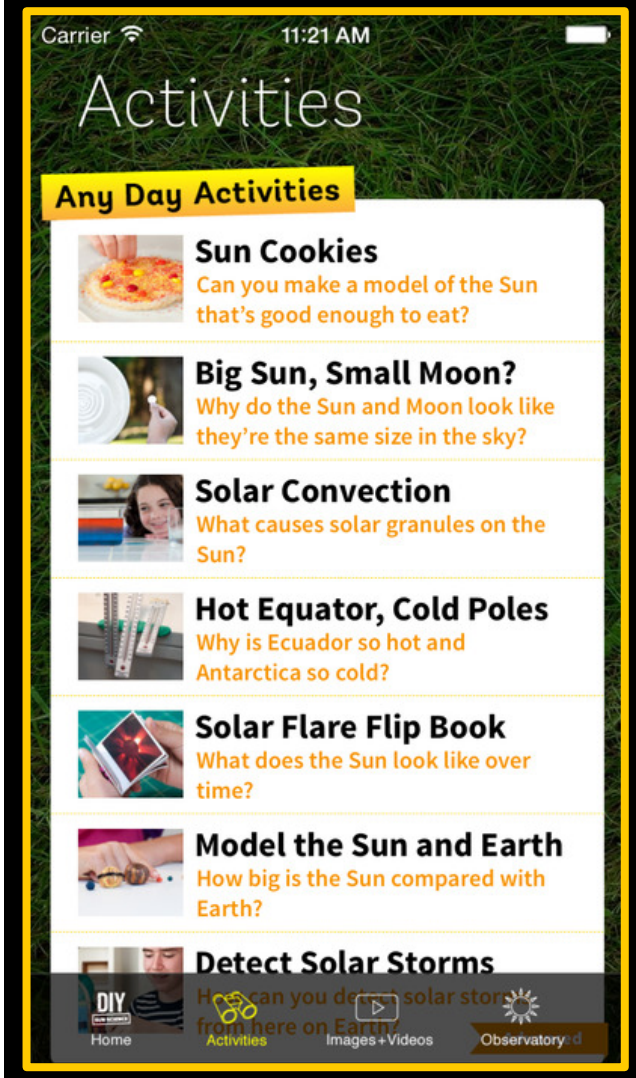
- Safety
- Activities
- Enthusiasm

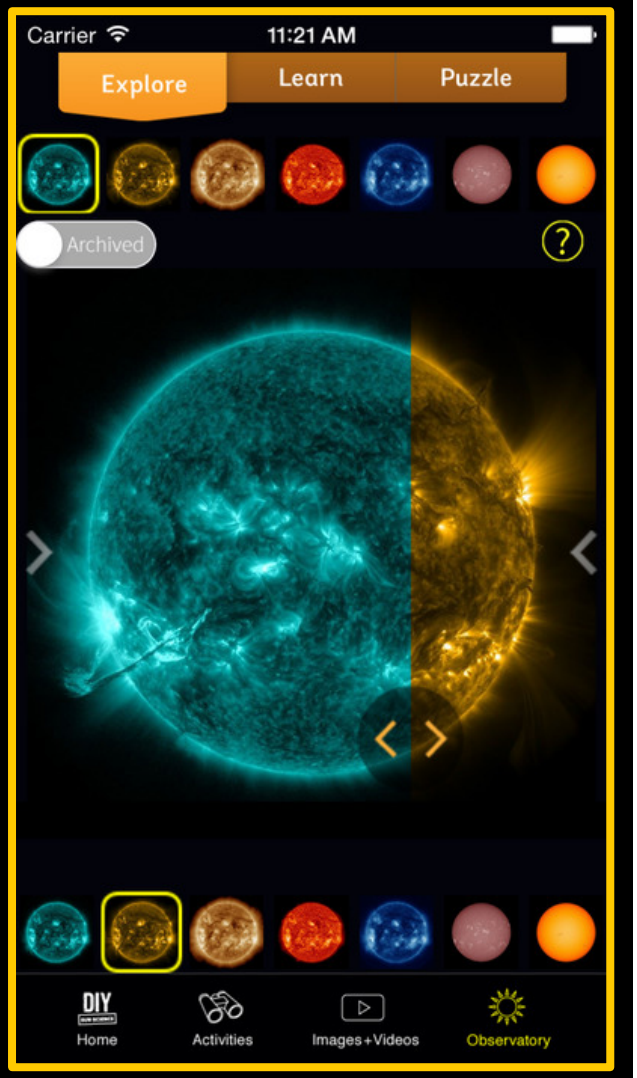
Optional:

- Solar Eclipse
- Marketing
- Clear Skies
- Solar Viewing
- Projectors
- Internet
- Food
- Parking
- Bathrooms
- Security


Jet Propulsion Laboratory
California Institute of Technology
ECLIPSE 2017 BETA
Eyes on the 2017 Eclipse
50%
75%
100%
75%
50%
Vancouver
Los Angeles
Kansas City
New York
50%
Houston
75%
9:50 AM
1:02 PM
TIME RATE
The Path of the Eclipse
Watch the great eclipse of August 21st, 2017, interactively! Pick your location on the Earth, scroll through time, and see if your view will be a partial eclipse (in the penumbra) or a total eclipse (in the umbra).
ust 21, 2017
10:34:05 AM Pacific Daylight Time
Los Angeles, CA
Kansas City, KS
Los Angeles, CA
Miami, FL


exploratorium
TOTAL Solar Eclipse
2017 Live Stream
How To View
About Eclipses
Past Eclipses
Total Solar Eclipse 2017:
Live from the USA
2016 Totality Highlights
2016 Total Solar Eclipse:
Live from Micronesia
Exploratorium
Live Webcast
37:56 / 59:50
To share or embed these webcasts into your website or blog, click the Share button in the video player control bar. Need help?.
TOTAL
Solar
LIVE from the
#Eclipse2017
Angela Speck





DIY Sun Science

Megamovie project

The Project

The Eclipse Megamovie Project will gather images of the 2017 total solar eclipse from over 1,000 volunteer photographers and amateur astronomers, as well as many more members of the general public. We'll then stitch these media assets together to create an expanded and continuous view of the total eclipse as it crosses the United States.

LEARN MORE

iNaturalist

Connect with Nature

Explore and share your observations from the natural world.

SIGN UP | EXPLORE

1 Record your observations

2 Share with fellow naturalists

3 Discuss your findings

List of online eclipse resource

NISE Net solar eclipse planning mini-kit

2017 Event Planning and Promotion Guide (pg. 13-16 for eclipse)
Preparing for a Partial Solar Eclipse slides (with presenter notes)
Exploring the Solar System: Big Sun, Small Moon *Spanish!*
Exploring the Solar System: Solar Eclipse *Spanish!*
*Activity links include solar eclipse poster, postcards, and all videos

Eyes on 2017 Eclipse

Exploratorium eclipse webcast

DIY Sun Science from Lawrence Hall of Science

Google Megamovie project

iNaturalist from California Academy of Science

NASA Eclipse 2017 website & NASA Eclipse Live Stream page

Upcoming NISE Network Eclipse Online Workshops

- How to Utilize Online Live Streams at Your Event, June 20th, 2pm EST
- Join the Eclipse Party! What Are You Doing to Celebrate the August 21st, 2017 Total Solar Eclipse? June 27th, 2pm EST

Learn more and register: http://www.nisenet.org/event-type/online-workshop

Thank you

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NETWORK

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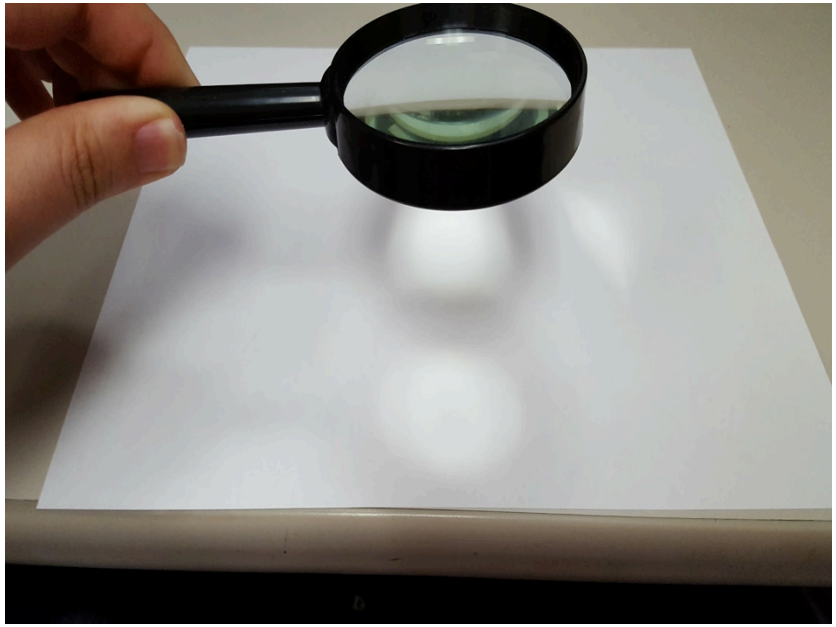
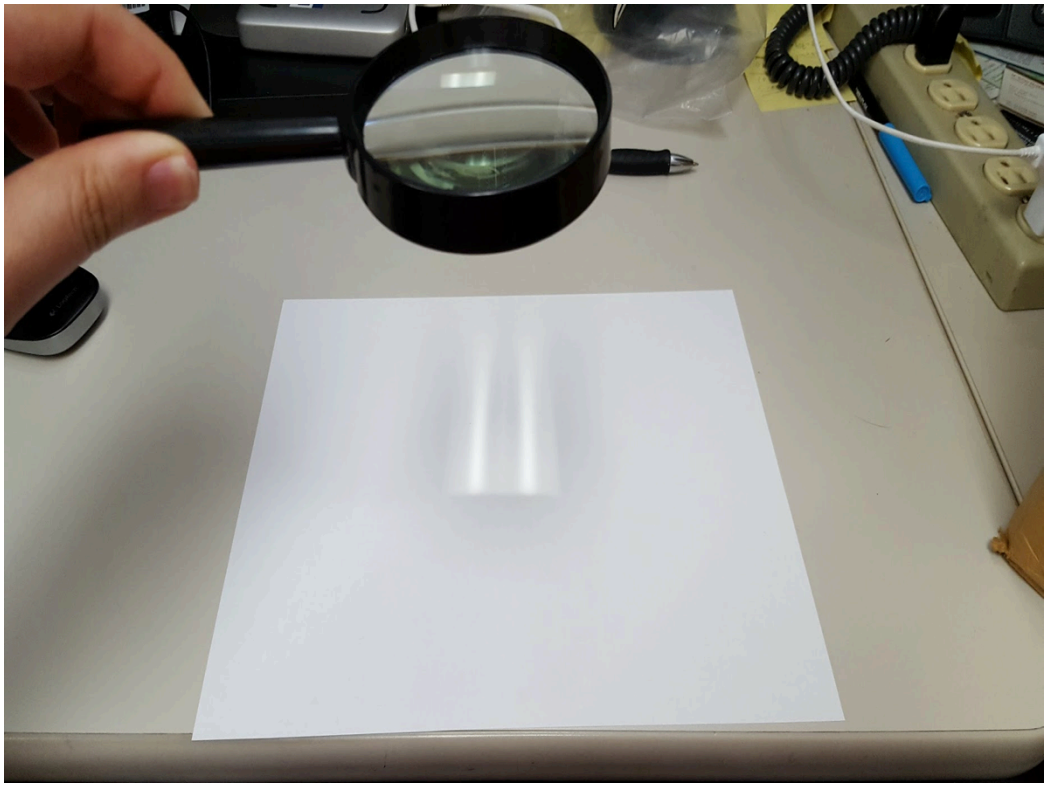
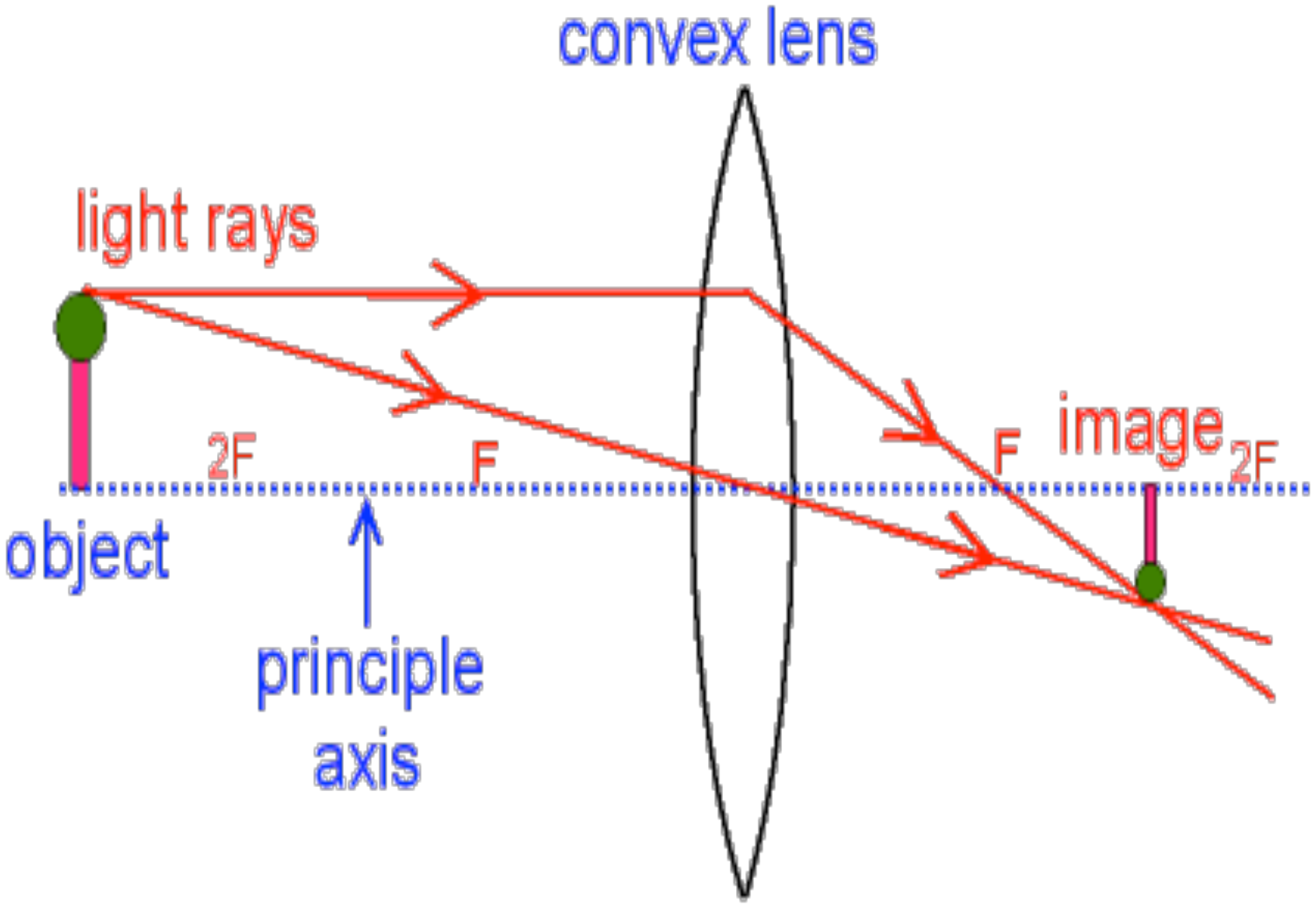
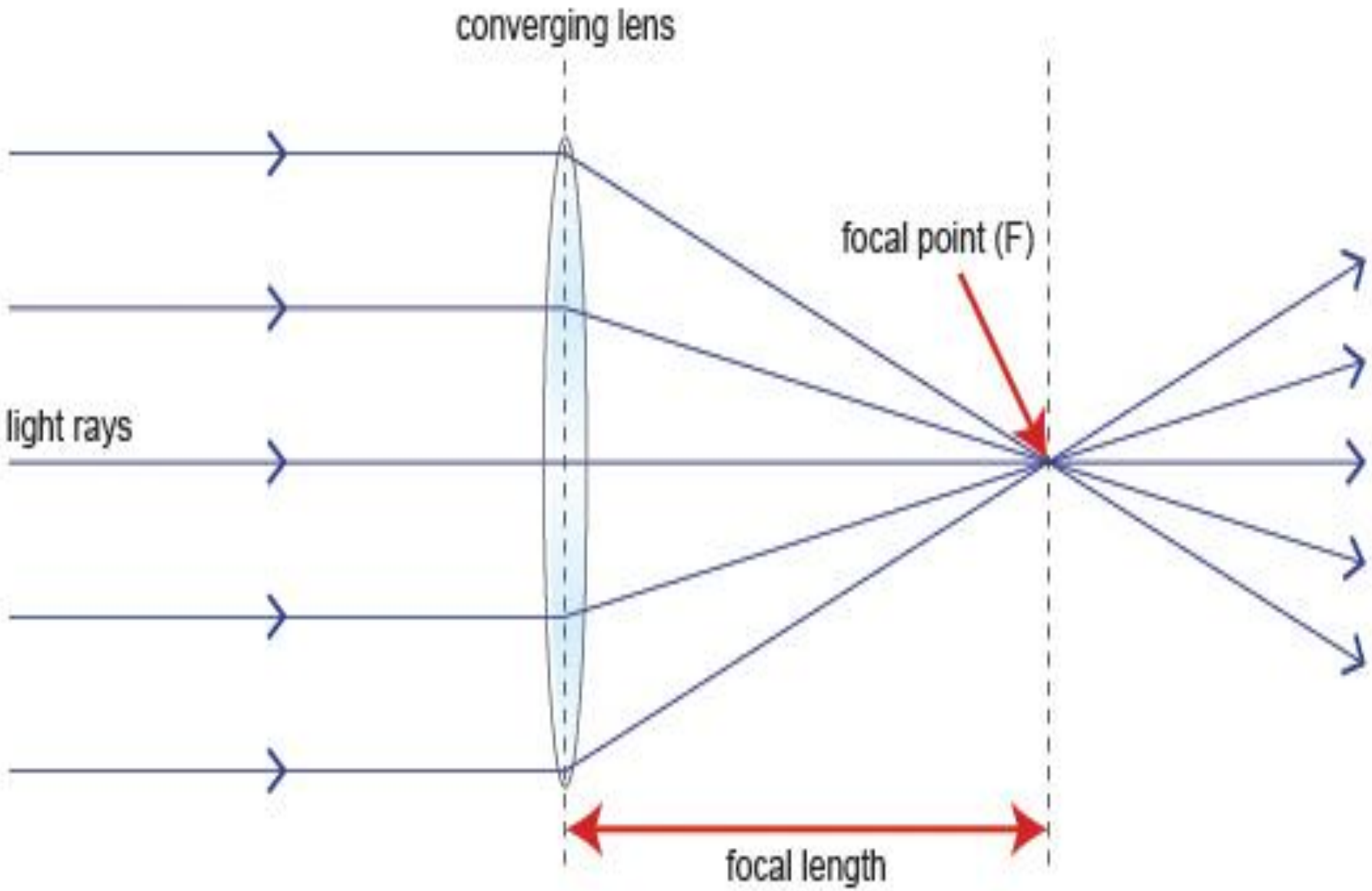
Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the view of the National Aeronautics and Space Administration (NASA).

Backup Slides






convex lens
light rays
2F
F
F
image
2F
object
principle
axis


converging lens
focal point (F)
light rays
focal length