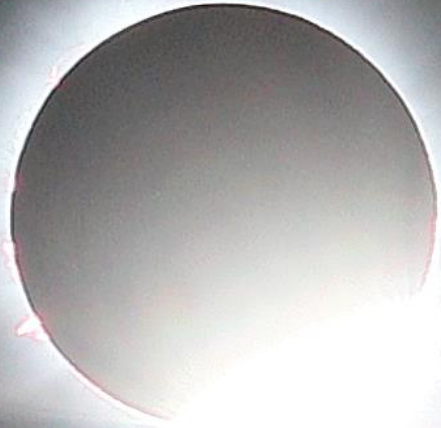


# Eclipse Mania



**Getting Ready for the Big Ones**

**October 14, 2023**

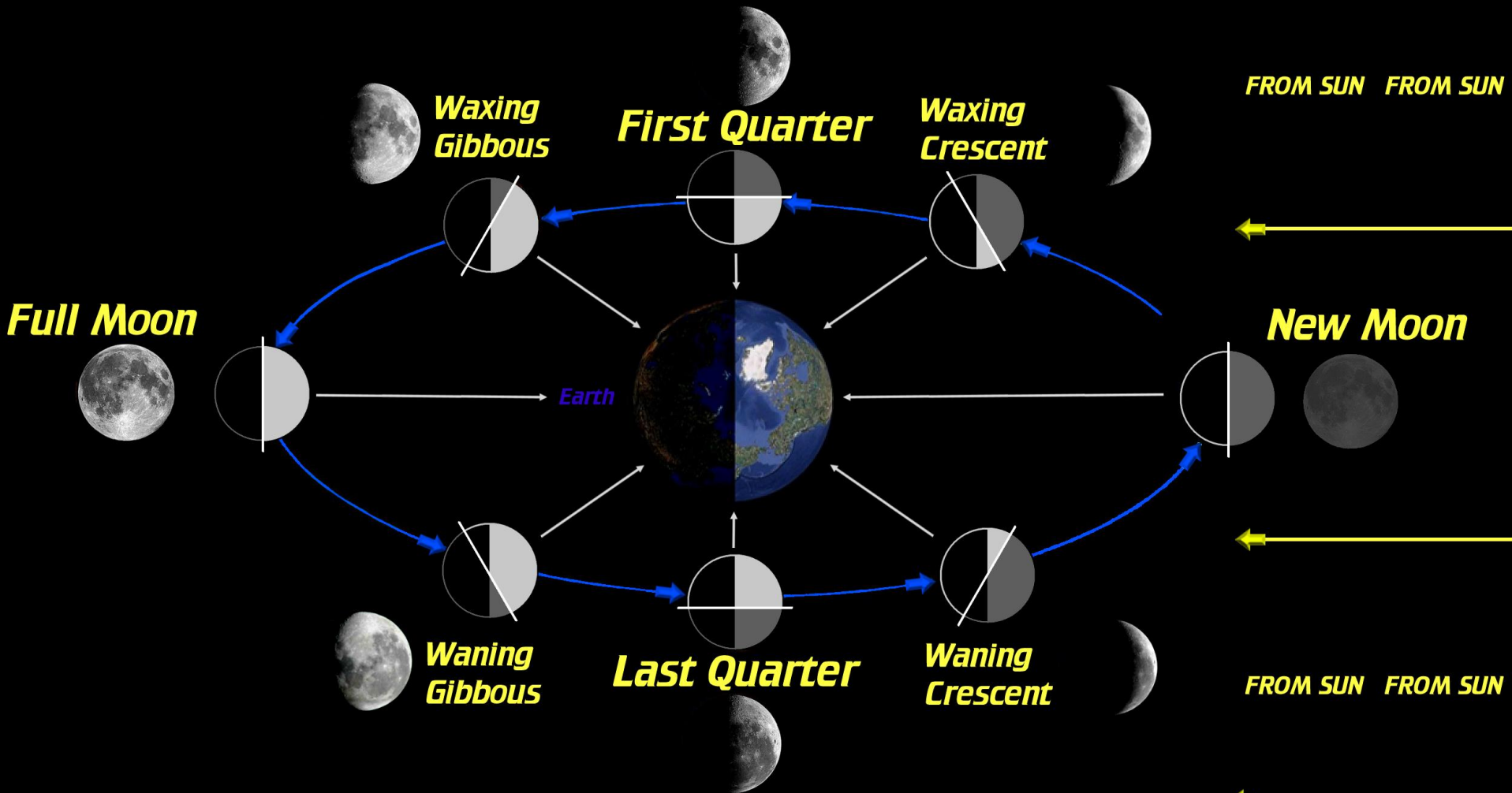
**April 8, 2024**

A total solar eclipse is depicted against a black background. The sun's bright corona is visible as a glowing white ring around a central black circle. The words "Eclipse" and "Talk" are written in white, bold, sans-serif font, stacked vertically in the center of the black circle.

# Eclipse Talk

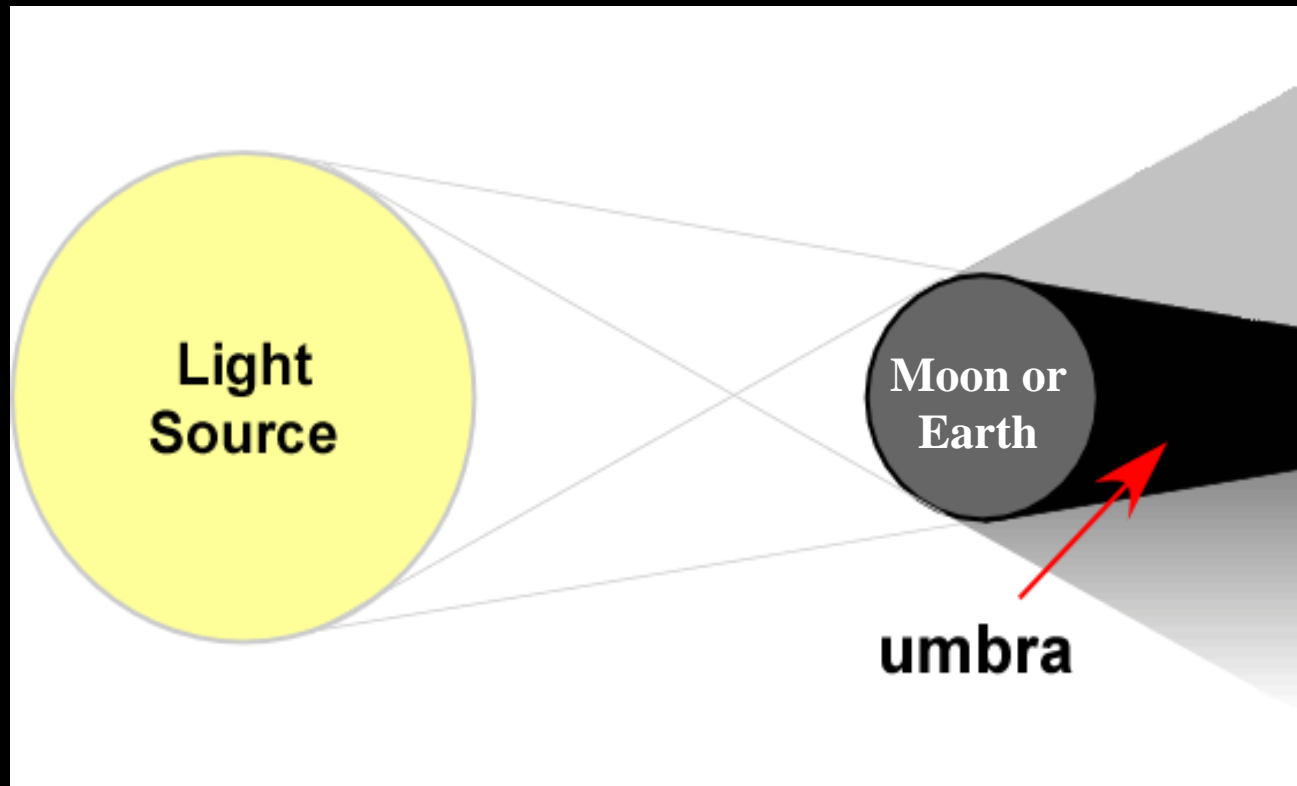
# Phases of the Moon

Synodic Period of the Moon equals 29.53059 days



# Umbra

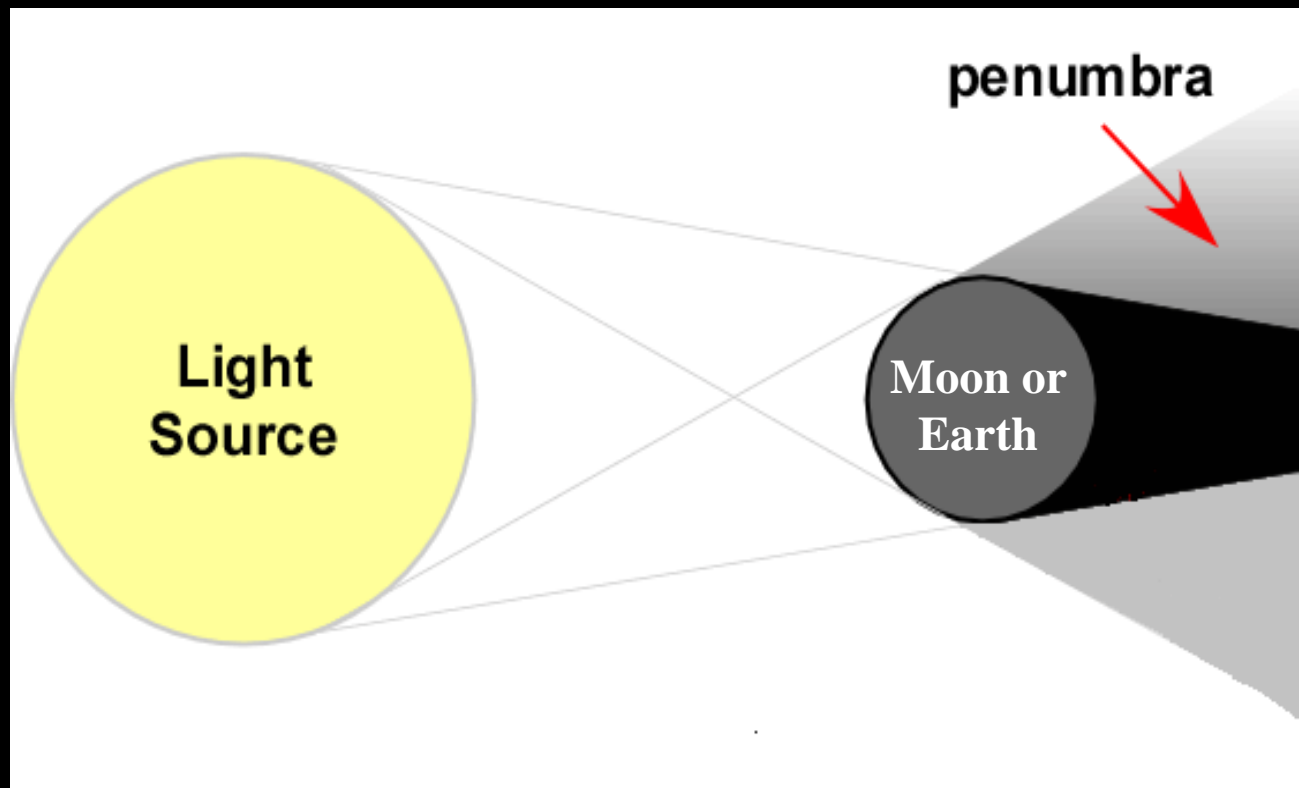
- Latin: "shadow"
- The darkest part of a shadow.
- Within the umbra, the source of light is completely blocked by the object causing the shadow.



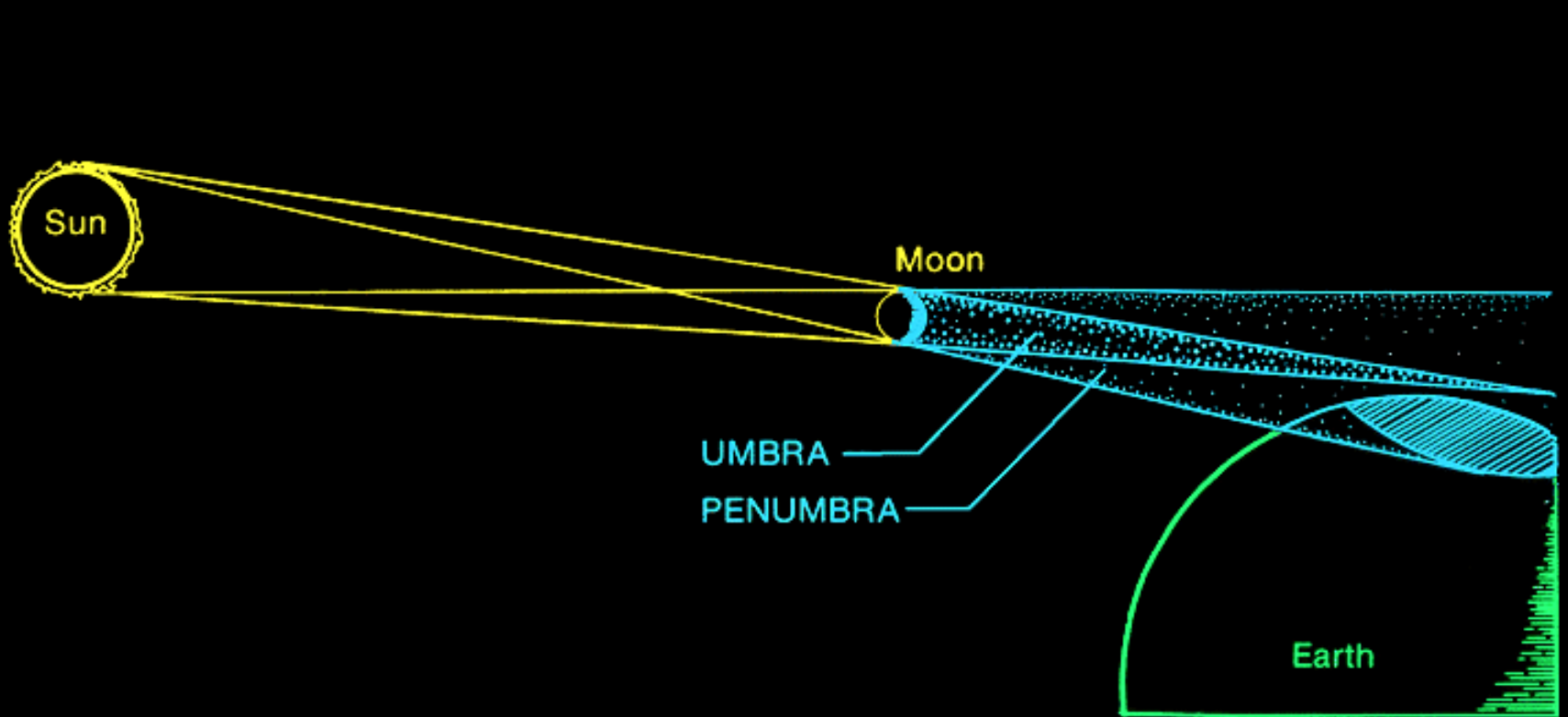


# Penumbra

- Latin: “Almost Shadow”
- Lighter part of the shadow.
- Source of illumination only partially blocked



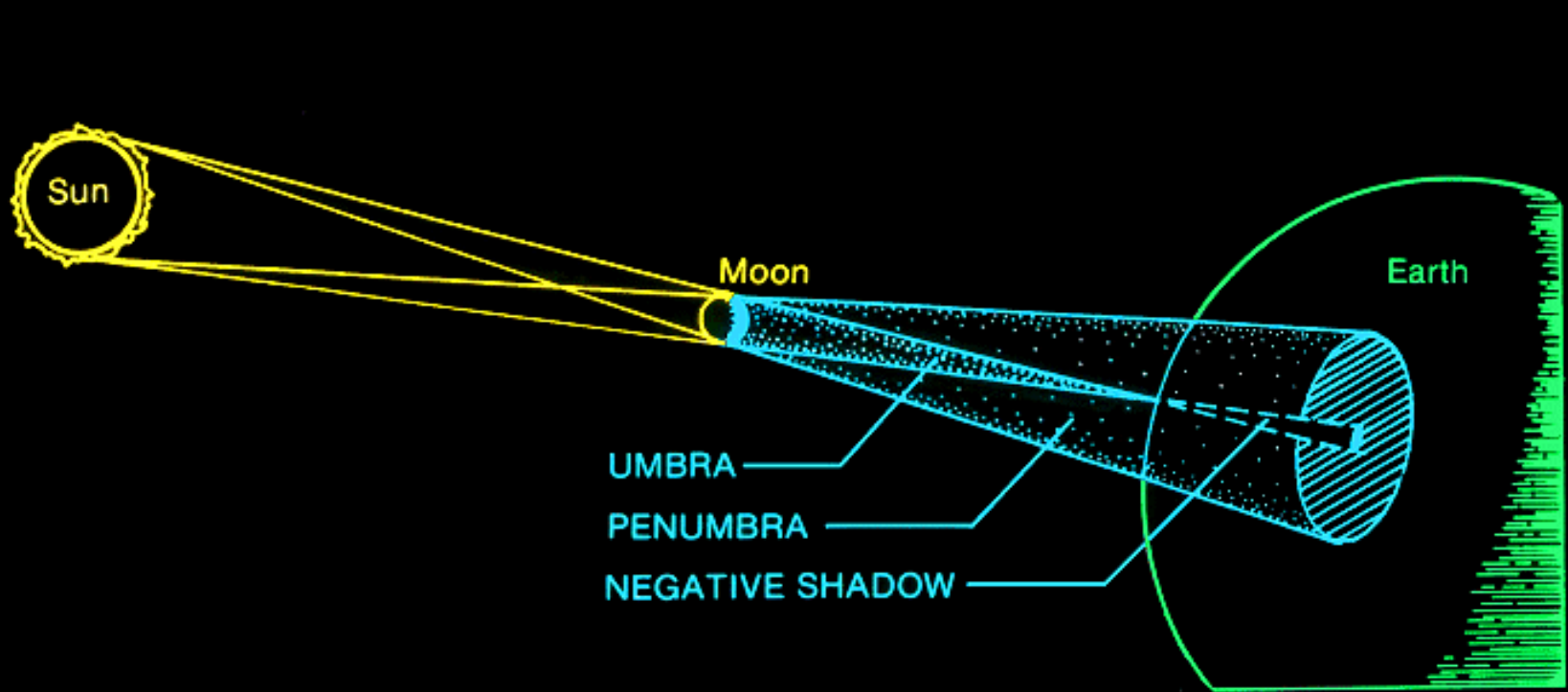
# *Partial Solar Eclipse*

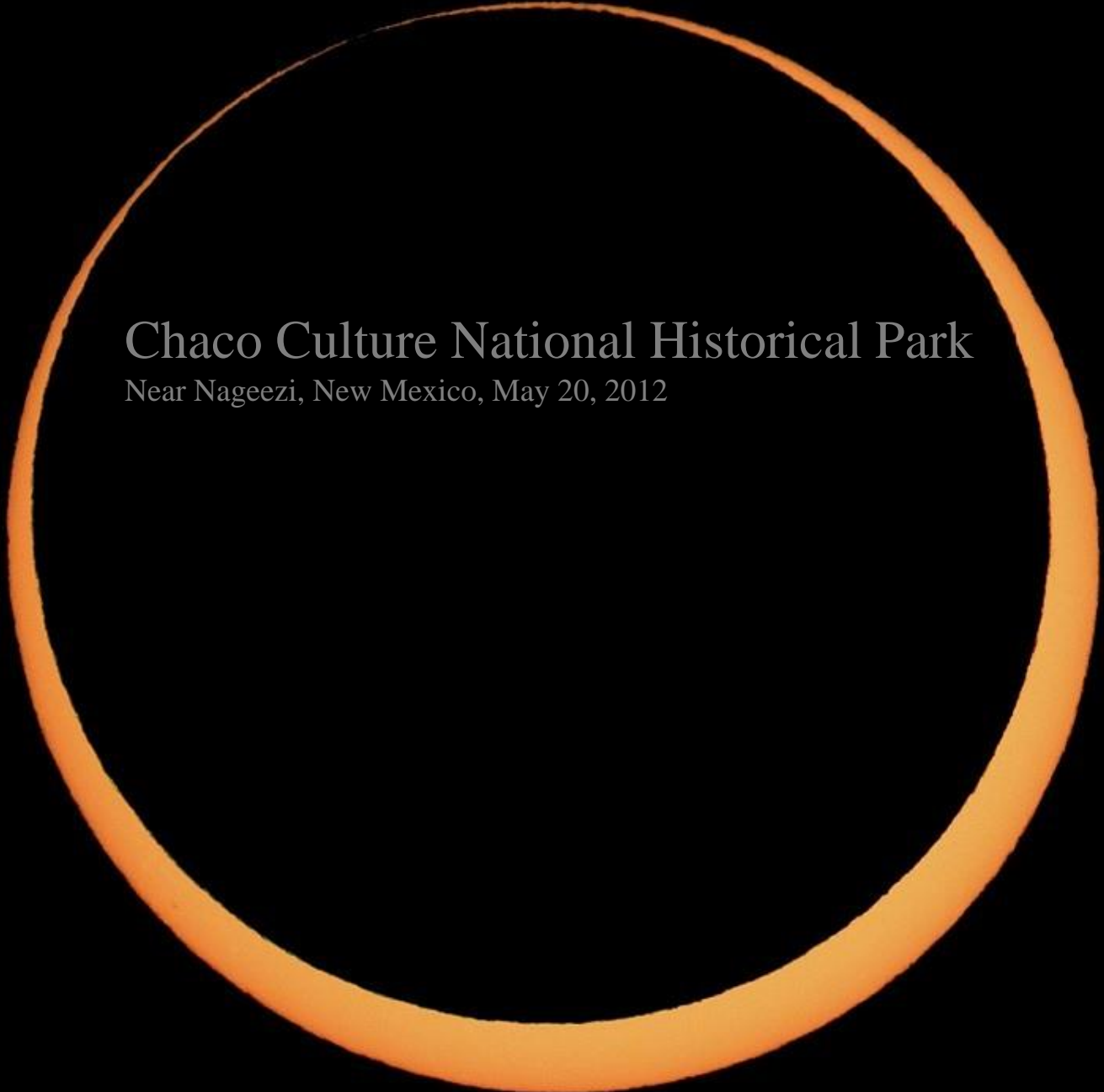


Partial Solar Eclipse, December 24, 1973  
Allentown, PA



# *Annular Eclipse*





Chaco Culture National Historical Park  
Near Nageezi, New Mexico, May 20, 2012

**May 30, 1984-Osceola, NC**

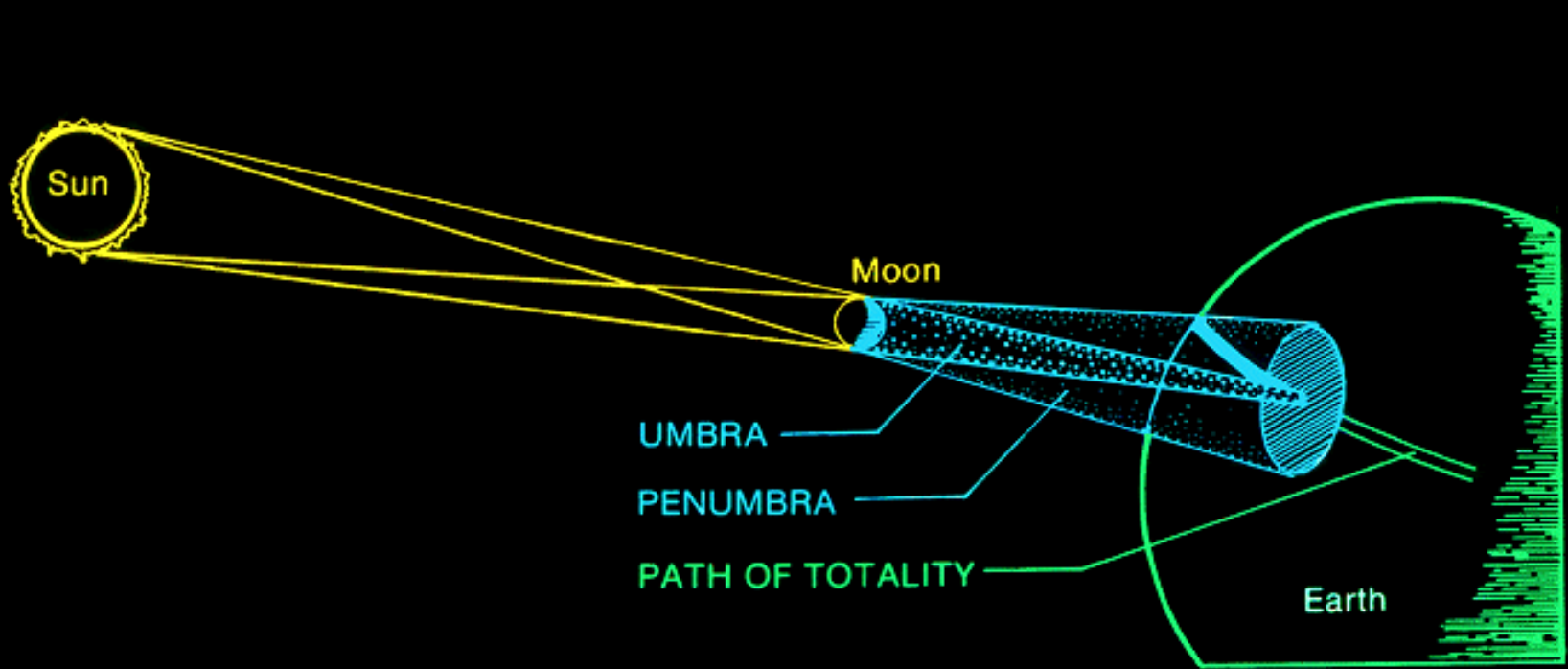
**Broken Annular Eclipse**



Charles Tackus image/Eclipse images, Gary A. Becker



# *Total Solar Eclipse*



# Total Solar Eclipse, August 21, 2017

Guernsey State Park, Guernsey, Wyoming





July 11, 2010—Patagonia



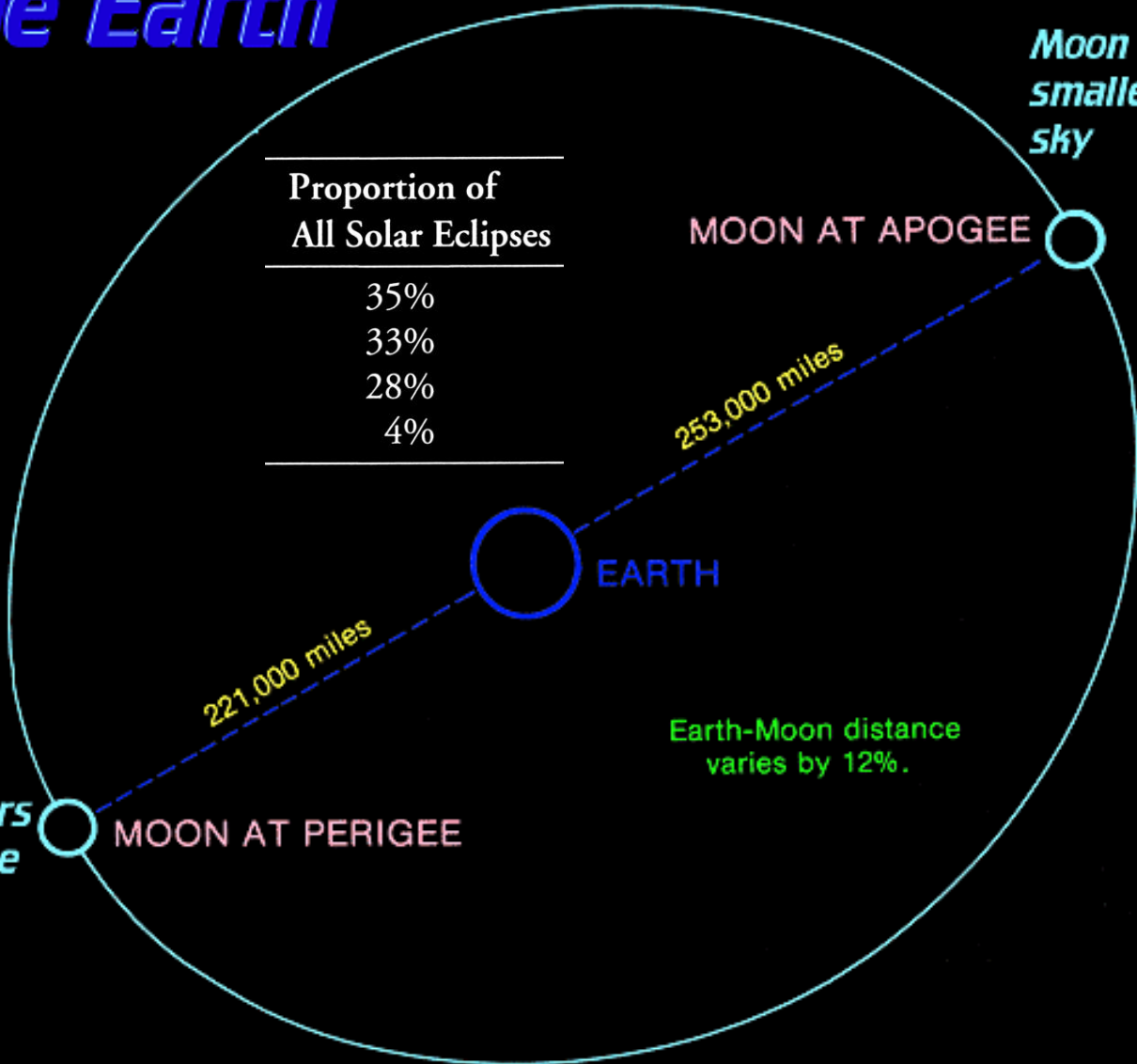
July 11, 2010--Janne Pyykko, El Calafate, Patagonia, Argentina,



# Moon's Changing Distance from the Earth

Type of Solar Eclipse
Partial
Annular
Total
Annular-total

Proportion of All Solar Eclipses
35%
33%
28%
4%



*Moon appears smallest in the sky*

*Moon appears largest in the sky*

Earth-Moon distance varies by 12%.

# Change in the Angular Diameter of the Moon

**Perigee Full Moon**



**March 19, 2011**

**221,614 miles**

**33 min, 30 sec**

**Apogee Full Moon**

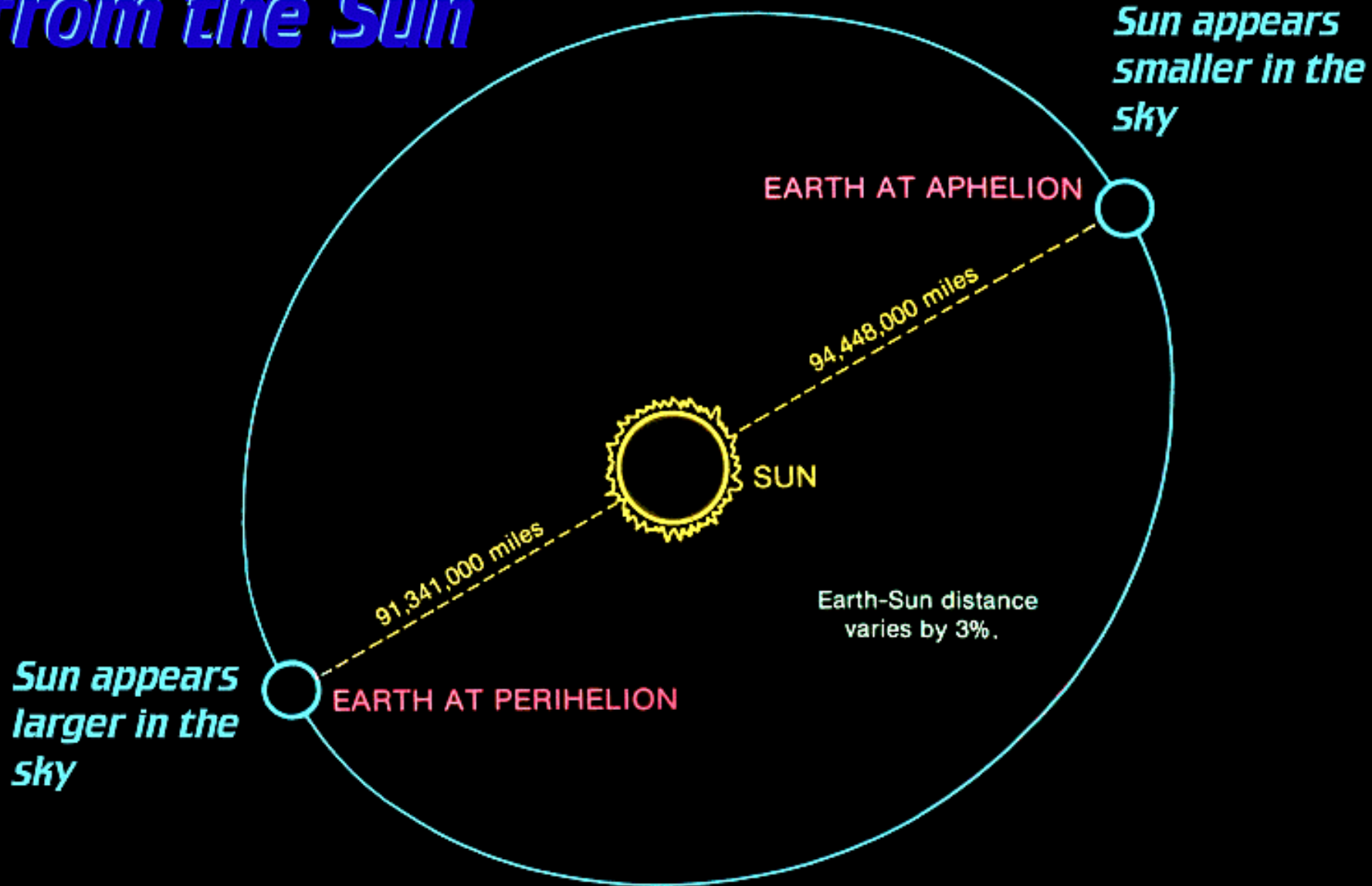


**November 28, 2012**

**252,459 miles**

**29 min, 24 sec**

# *Earth's Changing Distance from the Sun*





# Change in the Angular Diameter of the Sun

Perihelion



January 3, 2013  
91,330,000 miles  
32 min, 32 sec

Aphelion



July 3, 2014  
94,490,000 miles  
31 min, 28 sec

**Extreme  
Angular  
Diameters  
of the  
Sun  
and the  
Moon  
to  
Scale**

**2011-2014**

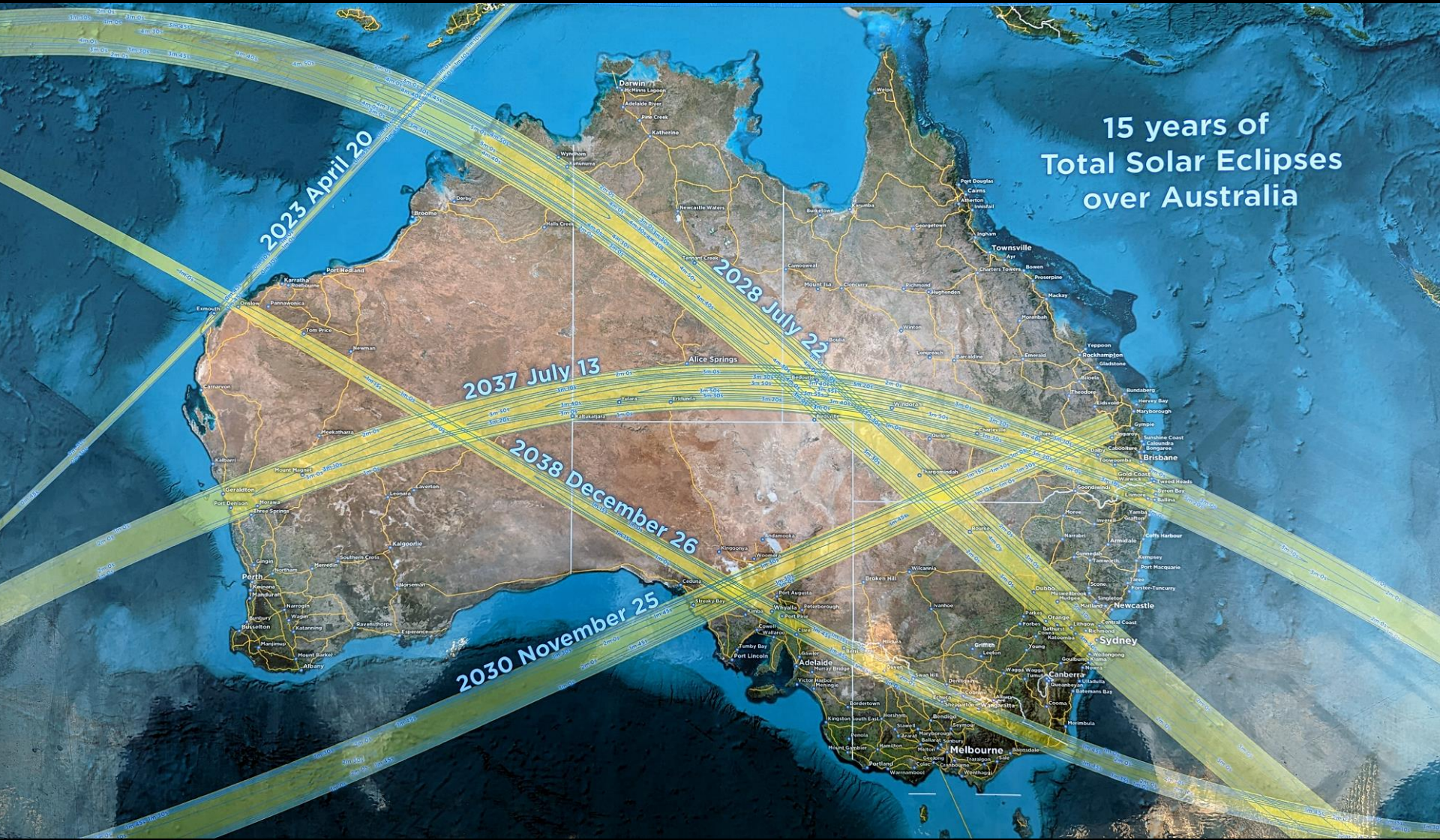




Detailed map  
of Australia



# 15 years of Total Solar Eclipses over Australia





# North West Coast Path of Totality April 20, 2023





# P & O Pacific Explorer















Peter K. Detterline image

























# Annular Eclipse

## Saturday, October 14, 2023

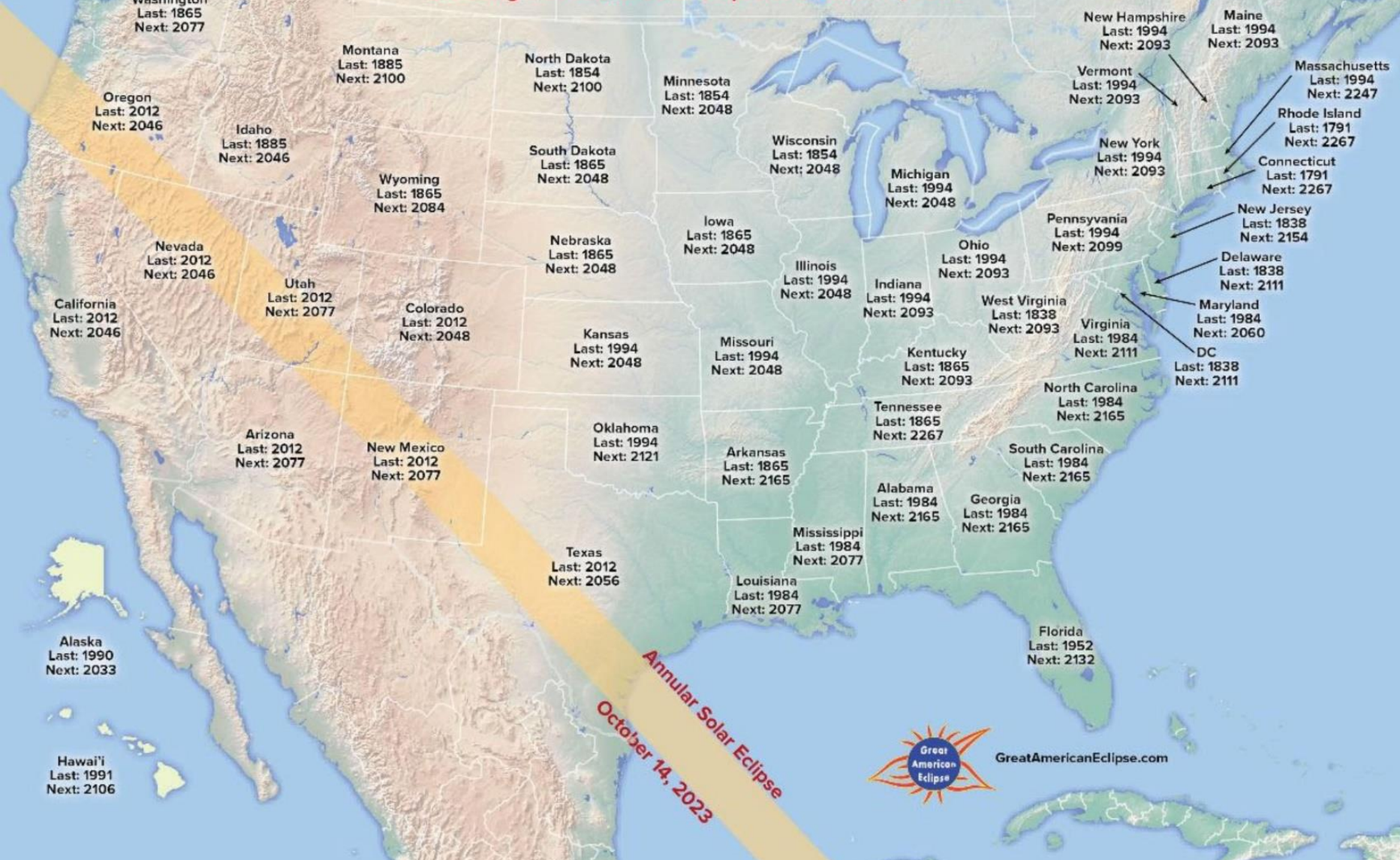






# Last and Next Annular Solar Eclipses for each of the United States

Excluding the Annular Solar Eclipse of October 14, 2023



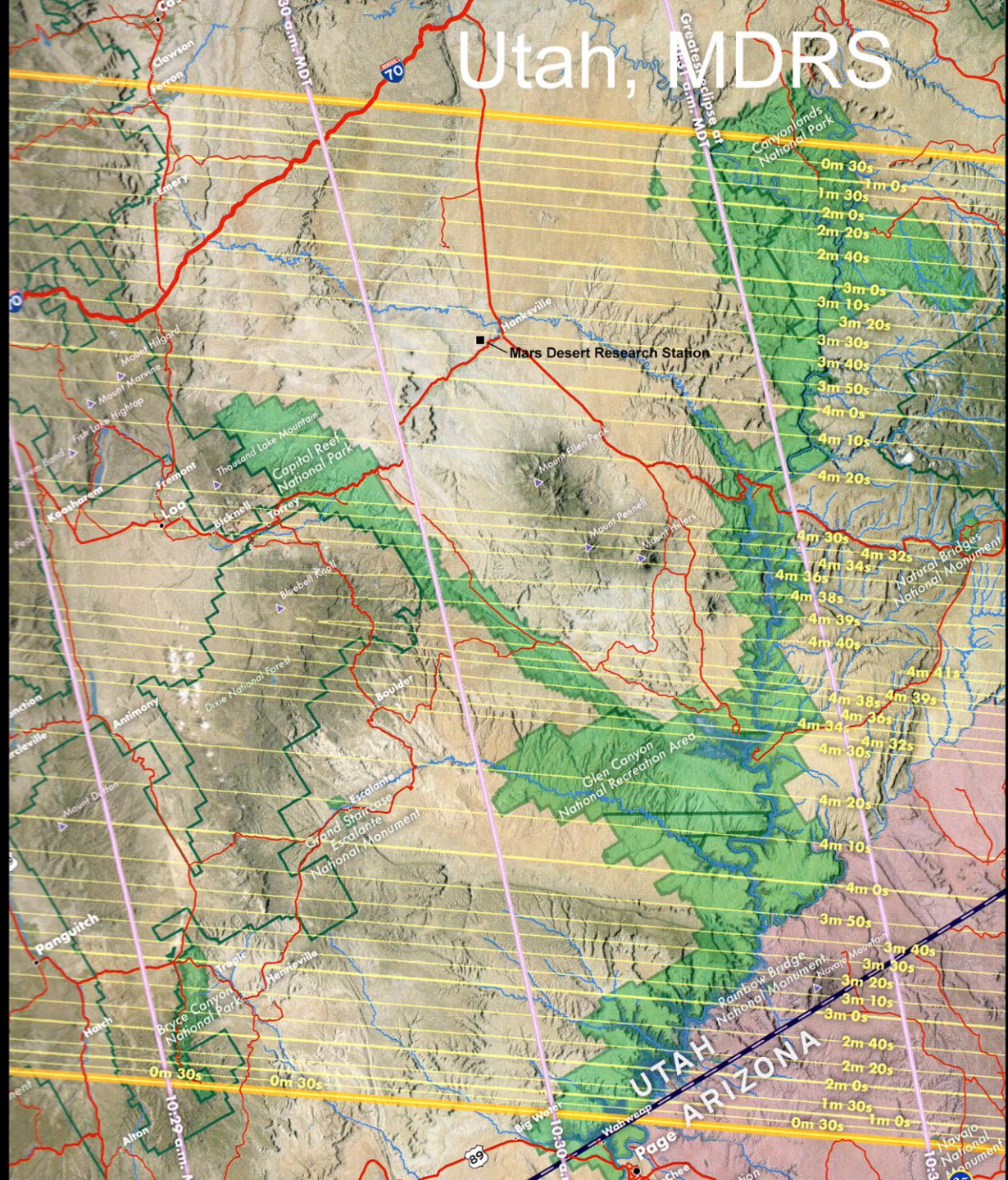
Annular Solar Eclipse  
October 14, 2023



GreatAmericanEclipse.com



# Utah, MDRS





# Road Atlas

for the

# Annular Solar Eclipse

of

# 2023

Fred Espenak

**COLOR  
EDITION**





40° 11' 54.32" N <-> 40.19842° Penumbral duration : 2h 32m 42.1s  
75° 47' 36.38" W <-> -75.79344° (partial solar eclipse) [Help](#)

Obscuration : 26.156%



Magnitude at maximum : 0.38111  
Moon/Sun size ratio : 0.94772

Event ( $\Delta T=69.1s$ )	Date	Time (EDT)	Alt	Azi	P	V
Start of partial eclipse (C1)	2023/10/14	12:03:51.3	+40.5°	165.2°	276°	02.4
Maximum eclipse (MAX)	2023/10/14	1:19:49.6	+41.1°	190.1°	222°	04.8
End of partial eclipse (C4)	2023/10/14	2:36:33.4	+35.6°	213.3°	168°	07.2

# French Creek State Park

French Creek Boat Rental

EV charging station

French Creek State Park  
Vast forest, trails, lakes & campsites

French Creek State Park Playground

Hopewell Lake Entrance  
French Creek S Entrance Dr Parking Lot



# Hawk Mountain Sanctuary

Hawk Mountain Amphitheater

Hawk Mountain Sanctuary  
Nonprofit facility with bird watching

Hawk Mountain Sanctuary Visitor Center

40° 38' 01.97" N <--> 40.63388° Penumbral duration : 2h 31m 50.4s [Help](#)  
75° 59' 15.94" W <--> -75.98776° (partial solar eclipse)

Obscuration : 25.887%



Magnitude at maximum : 0.37838  
Moon/Sun size ratio : 0.94764

Event ( $\Delta T=69.1s$ )	Date	Time (EDT)	Alt	Azi	P	V
Start of partial eclipse (C1)	2023/10/14	12:03:25.5	+40.0°	164.9°	275°	02.4
Maximum eclipse (MAX)	2023/10/14	1:18:56.2	+40.7°	189.5°	222°	04.8
End of partial eclipse (C4)	2023/10/14	2:35:15.8	+35.4°	212.6°	169°	07.2



# Path of Totality

## April 8, 2024





# An Easy One Day Drive







## Last and Next Total Solar Eclipses for each of the United States

Excluding the Total Solar Eclipse of April 8, 2024



Total Solar Eclipse  
April 8, 2024

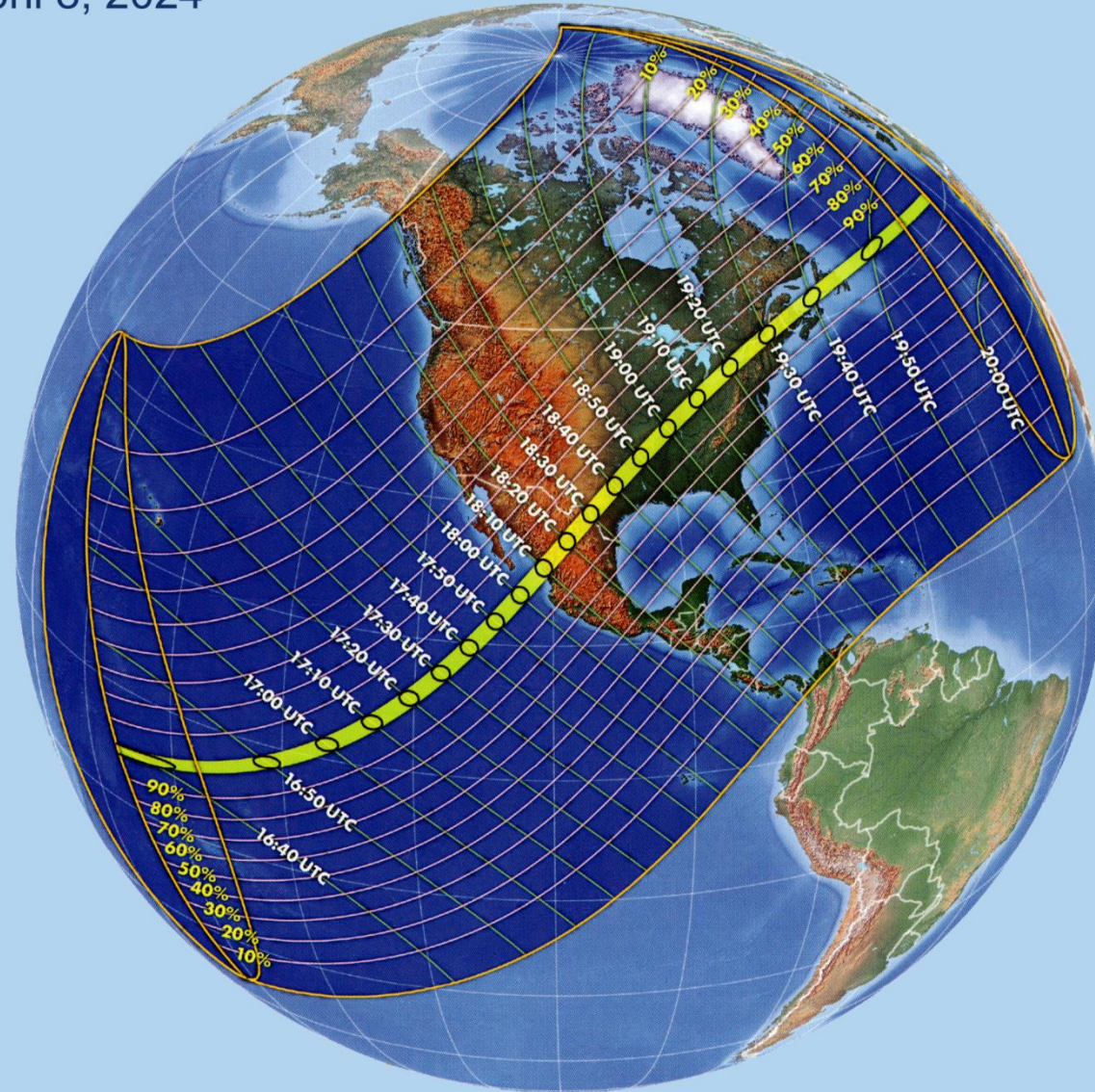


GreatAmericanEclipse.com



# Times of Totality

April 8, 2024





40° 11' 54.19" N <-> 40.19838° Penumbral duration : 2h 27m 16.2s [Help](#)  
 75° 47' 36.60" W <-> -75.79350° (partial solar eclipse)  
 -1.0m (-3ft)

Obscuration : 90.382% Max  Magnitude at maximum : 0.91437  
 Moon/Sun size ratio : 1.05204

Event ( $\Delta T=69.1s$ )	Date	Time (EDT)	Alt	Azi	P	V
Start of partial eclipse (C1)	2024/04/08	2:07:21.8	+54.5°	207.4°	238°	04.8
Maximum eclipse (MAX)	2024/04/08	3:22:59.1	+45.2°	232.9°	324°	02.5
End of partial eclipse (C4)	2024/04/08	4:34:38.0	+33.2°	249.9°	049°	11.9



# French Creek State Park



# Hawk Mountain Sanctuary

Hawk Mountain Amphitheater

Hawk Mountain Sanctuary  
Nonprofit facility with bird watching

Hawk Mountain Sanctuary Visitor Center



40° 38' 01.88" N <-> 40.63386° Penumbral duration : 2h 27m 12.3s [Help](#)  
75° 59' 15.81" W <-> -75.98772° (partial solar eclipse)

Obscuration : 92.270%



Magnitude at maximum : 0.92938  
Moon/Sun size ratio : 1.05201

Event ( $\Delta T=69.1s$ )	Date	Time (EDT)	Alt	Azi	P	V
Start of partial eclipse (C1)	2024/04/08	2:07:22.7	+54.2°	206.8°	237°	04.8
Maximum eclipse (MAX)	2024/04/08	3:22:56.4	+45.0°	232.3°	324°	02.5
End of partial eclipse (C4)	2024/04/08	4:34:35.0	+33.1°	249.4°	050°	11.9



**Solar Max**  
**1991**



**Solar Min**  
**2009**



# Centerline and the Weather



April 1, 2023, 1 p.m. EDT

NCAR  
RAL



April 2, 2023, 1 p.m. EDT

NCAR  
RAL



April 3, 2023, 1 p.m. EDT

NCAR  
RAL



April 4, 2023, 1 p.m. EDT

NCAR  
RAL

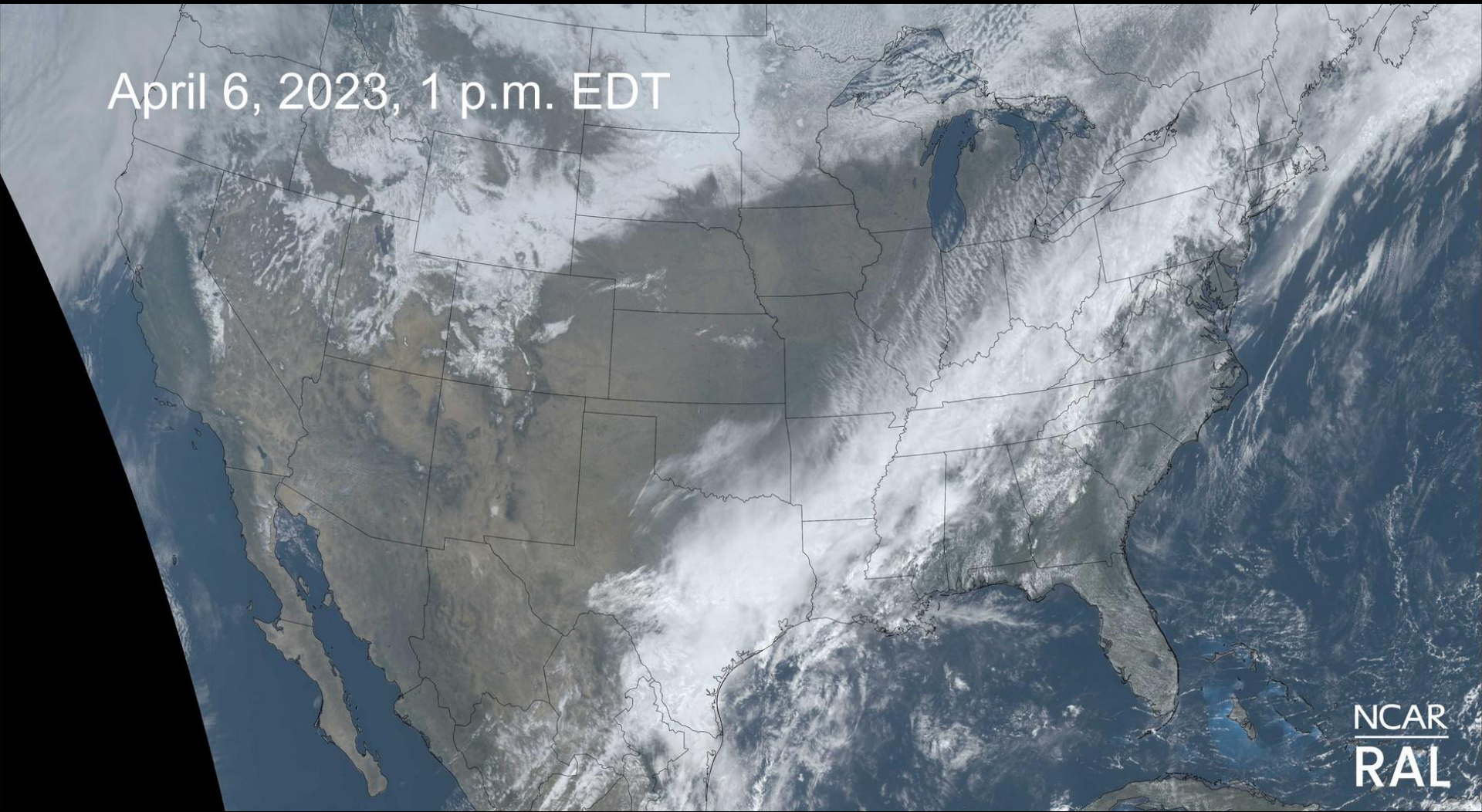


April 5, 2023, 1 p.m. EDT

NCAR  
RAL



April 6, 2023, 1 p.m. EDT



NCAR  
RAL



April 7, 2023, 1 p.m. EDT

NCAR  
RAL



April 7, 2023, 1 p.m. EDT

NCAR  
RAL



April 8, 2023, 1 p.m. EDT

NCAR  
RAL



April 9, 2023, 1 p.m. EDT

NCAR  
RAL



April 10, 2023, 1 p.m. EDT

NCAR  
RAL



A satellite-style map of the Great Lakes region and surrounding areas. The Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) are highlighted in a dark blue color. The surrounding landmasses are shown in a light blue/white color, and the ocean is in a darker blue. The map shows a large area of white clouds over the western part of the Great Lakes, indicating a reverse lake effect. The text "Reverse Lake Effect" and "July 4, 2023, 4 p.m. EDT" is overlaid on the map.

***Reverse Lake Effect***  
***July 4, 2023, 4 p.m. EDT***

NCAR  
RAL



# **Gear and Techniques**



# Get Your Eclipse Glasses Now!

<https://www.rainbowsymphony.com/>





May 10, 1994,  
Canutillo, Texas



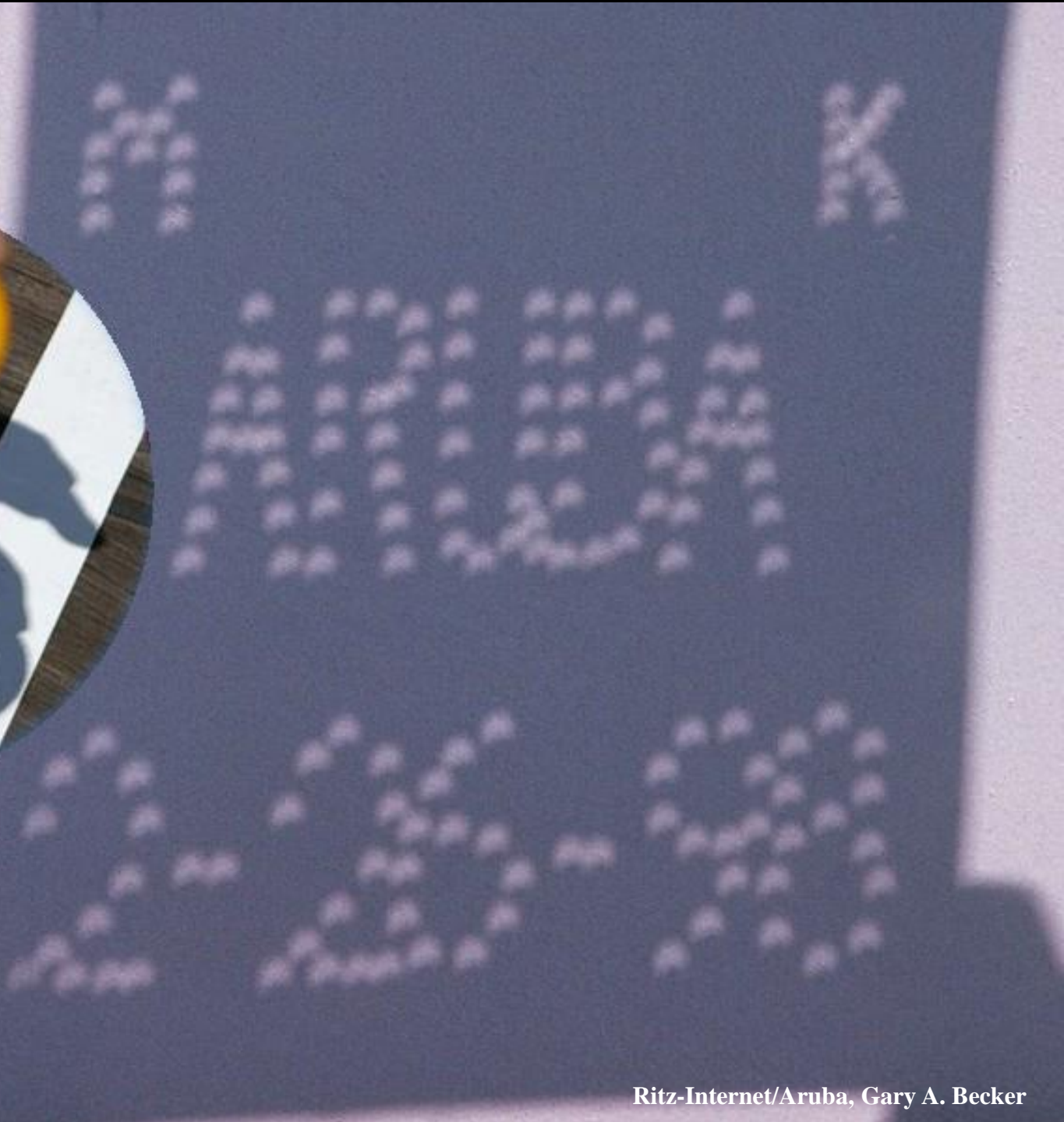


**May 10, 1994,  
Canutillo, Texas**





*Putting on the Ritz!*





May 10, 1994,  
Canutillo, Texas





May 10, 1994,  
Canutillo, Texas







Adam R. Jones photo

May 10, 1994,  
Canutillo, Texas

# *Solar Projection Box*

1. Cut 1" square opening at end and 1"x4" opening on side of cardboard box.

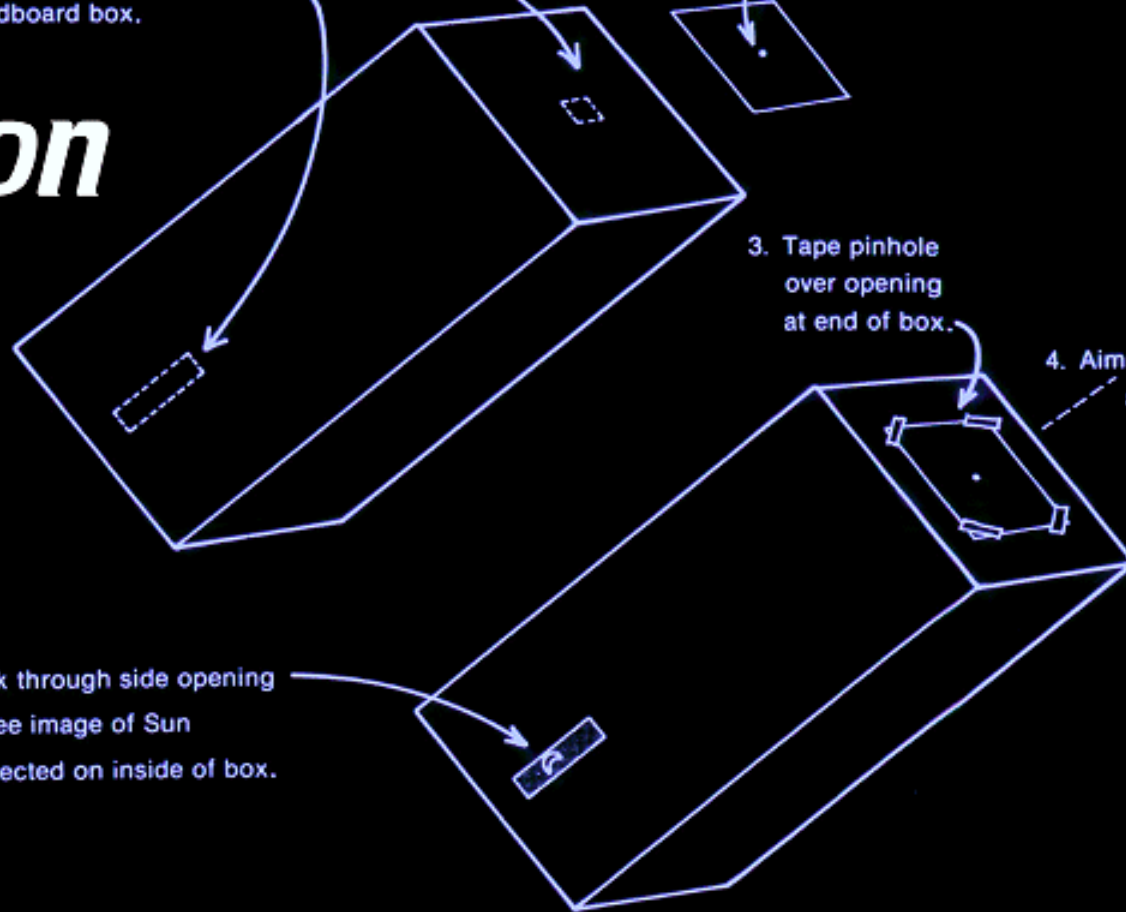
2. Make pinhole in large piece of aluminum foil.

3. Tape pinhole over opening at end of box.

4. Aim projector at Sun.

5. Look through side opening to see image of Sun projected on inside of box.

CAUTION: Never look through the pinhole directly at the Sun.





July 22, 2009-South China Sea



# No. 14 Welder's Filter

Welder's Filters are additive, so any combination which adds up to 14 is acceptable.

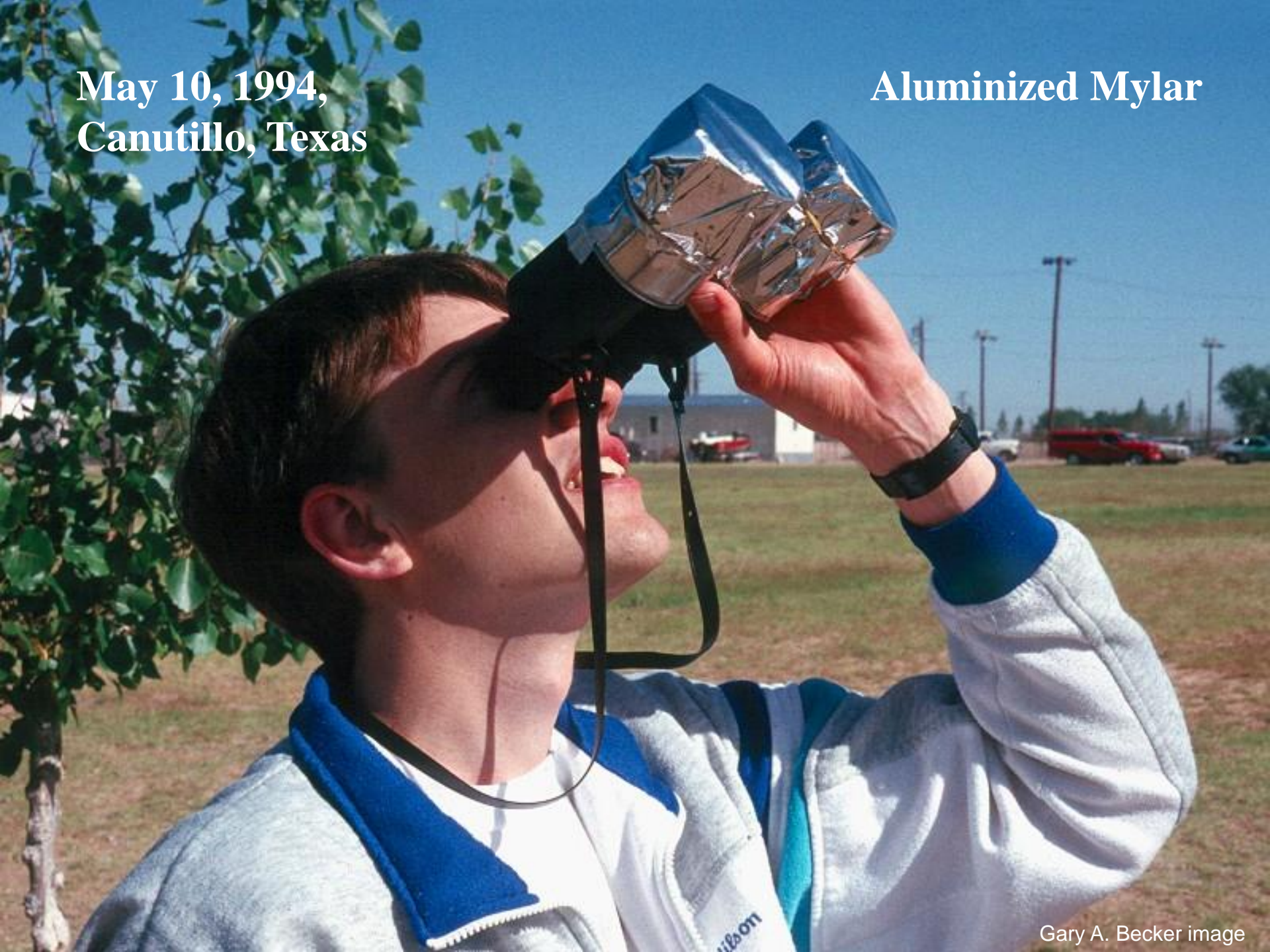


No. 13 Welder's filter is safe, if it's hazy.



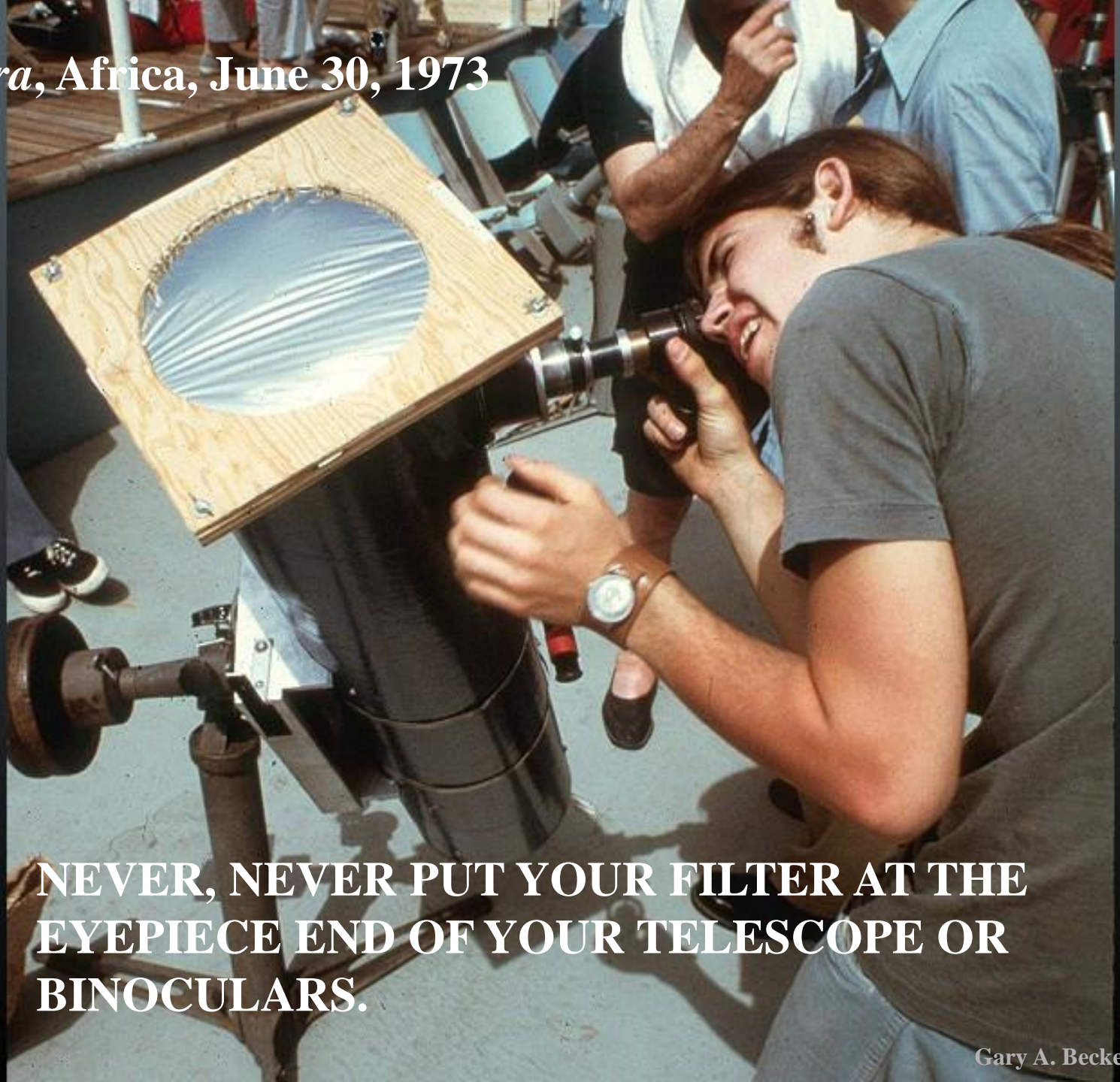
**May 10, 1994,  
Canutillo, Texas**

**Aluminized Mylar**





*Canberra, Africa, June 30, 1973*



**NEVER, NEVER PUT YOUR FILTER AT THE  
EYEPIECE END OF YOUR TELESCOPE OR  
BINOCULARS.**



April 20 2023  
NWC Australia

# Smart Phone Photography





# August 21, 2017 Total Solar Eclipse



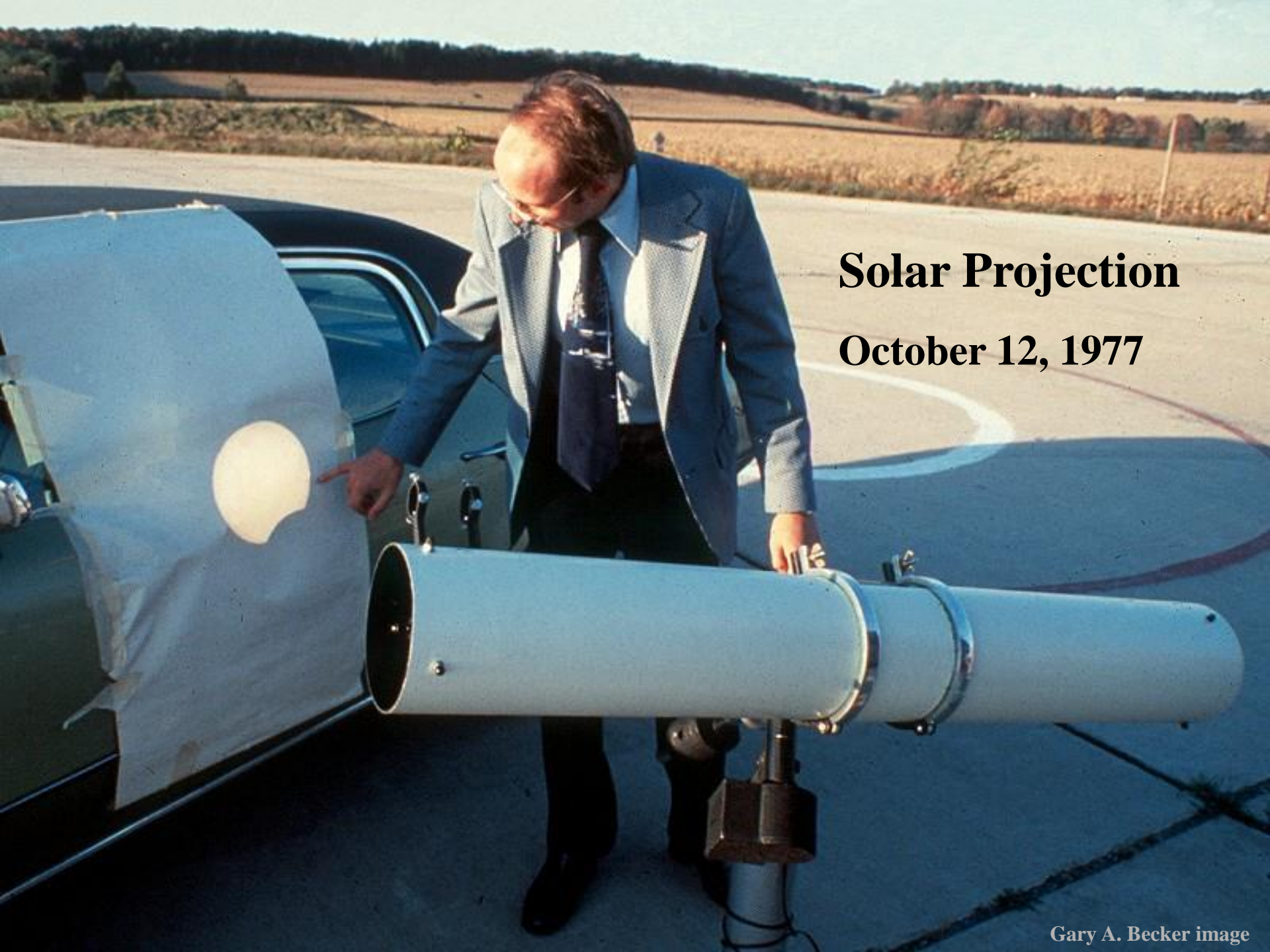
Phone camera held over a telescope eyepiece



# Google Pixel 7 Pro, Handheld

Canadian Smoke Providing the Filter, 25 Power



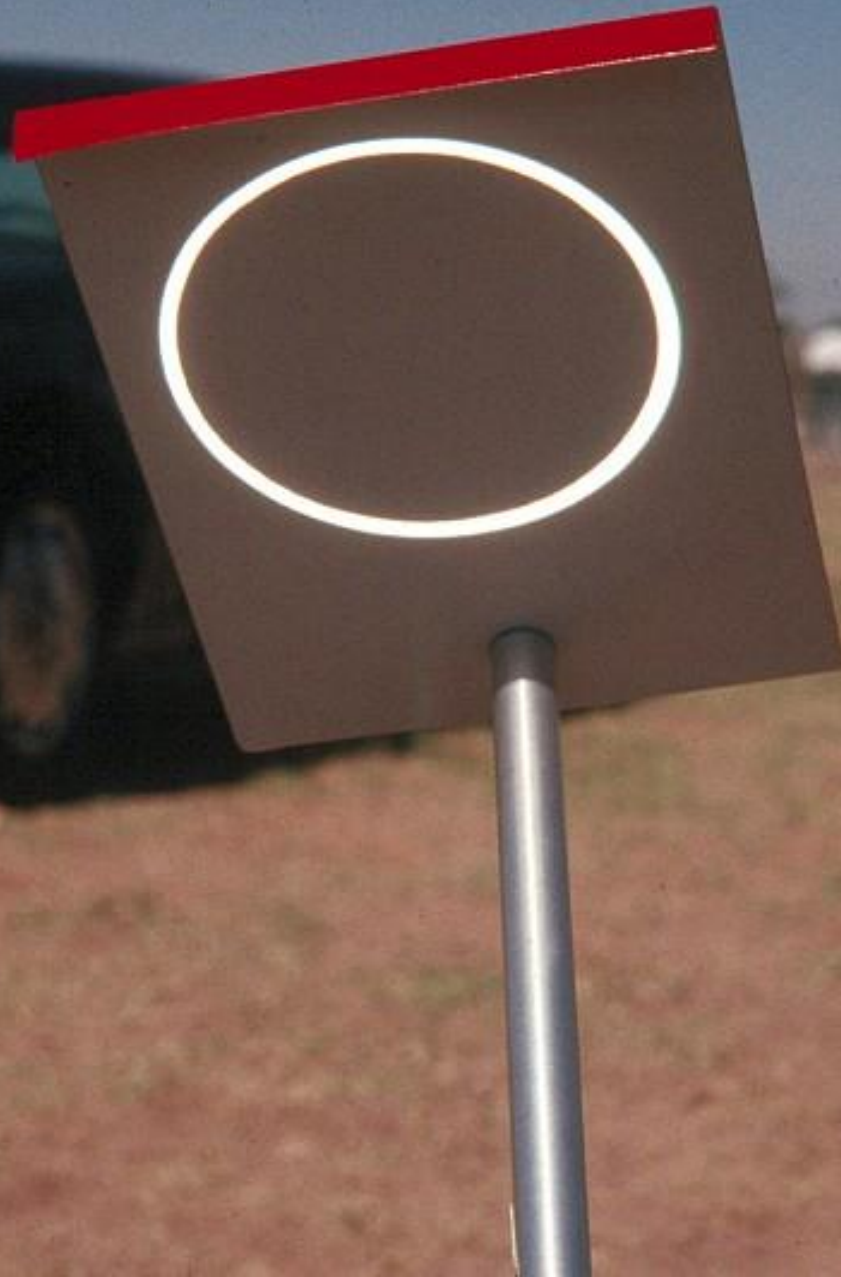


# **Solar Projection**

**October 12, 1977**



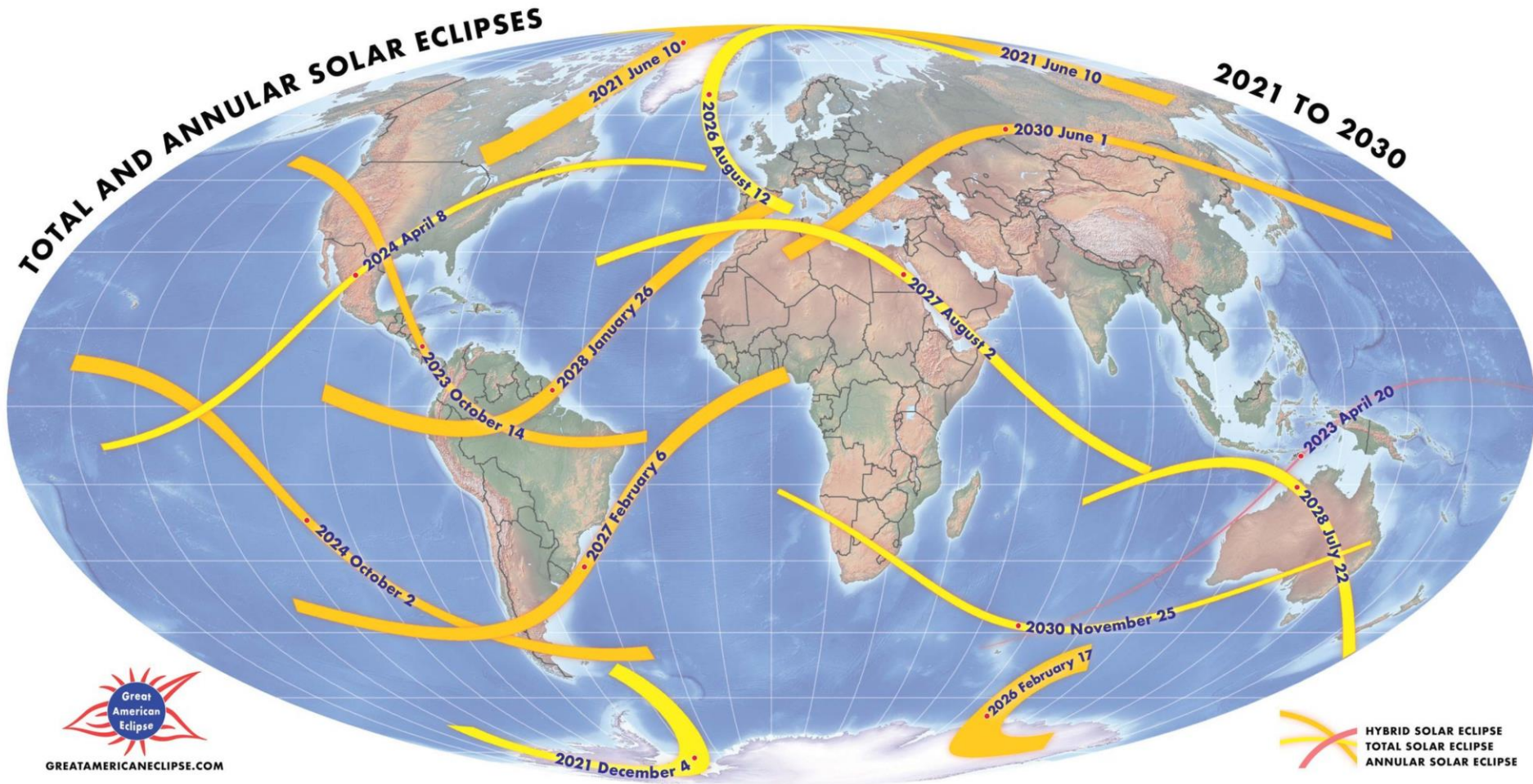
May 10, 1994,  
Canutillo, Texas



# Looking Forward to the Next Solar Eclipse

TOTAL AND ANNULAR SOLAR ECLIPSES

2021 TO 2030



GREATAMERICANECLIPSE.COM

HYBRID SOLAR ECLIPSE  
TOTAL SOLAR ECLIPSE  
ANNULAR SOLAR ECLIPSE



*La Fin*



What does the Milky Way Galaxy look like?



M39: Open or Galactic Cluster

The image displays a vast field of stars, characteristic of an open cluster. The stars are densely packed, with a higher concentration in the central region. A notable feature is the presence of several bright blue stars scattered throughout the field, particularly in the central and right-hand portions. The background is a dark, deep black, which makes the individual points of light stand out sharply. The overall appearance is that of a rich, multi-colored stellar population.





Double Cluster in Perseus

Open or Galactic Cluster

Related to each other/11 million yo



# M13: Great Globular Cluster in Hercules

22,200 light years distant

11.6 billion years old

300,000 to 500,000 stars

# M92-Hercules-Globular Cluster

26,700 light years distant

13 billion years old

200,000 stars





How will most stars die?



M57: Ring Nebula

2300 light years distant

7000 years old

# Ursa Major's Alcor and Mizar

A Visual Double Star





# Alcor and Mizar-Ursa Major

Alcor



Mizar



# Epsilon Lyrae: The Double-Double

## Epsilon Lyrae (Double-Double)

Sketch by Ewan Bryce

### Epsilon 2

Eps-2 C — \*\* — Eps-2 D

Eps-1 A — \* — Eps-1 B

### Epsilon 1

Lyra, the Harp

Vega

Epsilon Lyrae

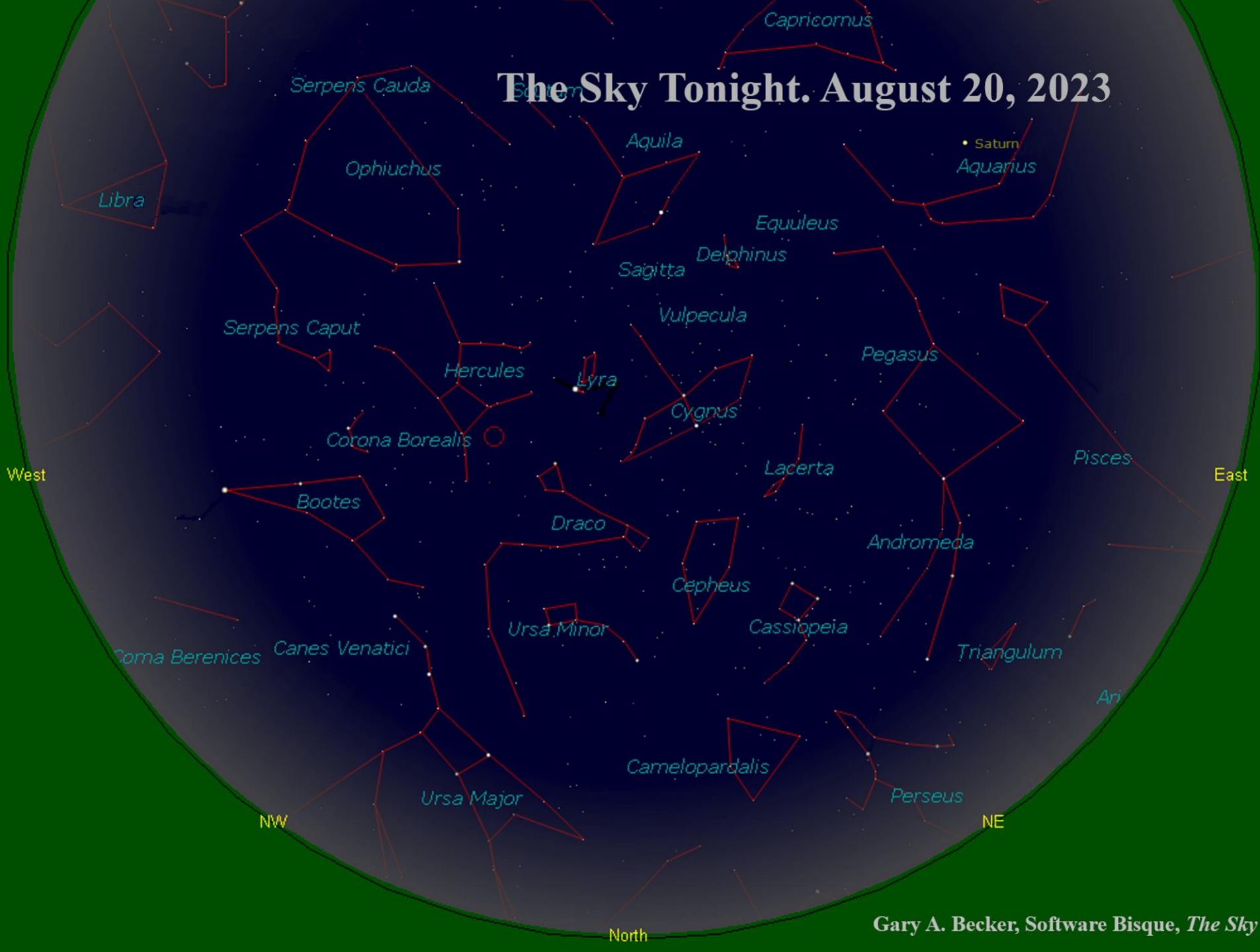
Epsilon 2.

Epsilon 1

All are fast spinners	Epsilon-1 A	Epsilon-1 B	Epsilon-2 C	Epsilon-2 D
Apparent Magnitude	+5.1	+6.0	+5.1	+5.4
Spectral Class	A <sub>3</sub>	A <sub>7</sub>	A <sub>5</sub>	A <sub>5</sub>
Temperatures	8000 K	7700 K	8200 K	8200 K
Luminosities (Sun = 1)	18	8	17	14
Mass (Sun = 1)	1.9	1.5	1.9	1.8



# The Sky Tonight. August 20, 2023



# Telescope Etiquette

- Telescopes are expensive. Please DON'T TOUCH!
- Supervise your children.
- No white lights, flash photography, pets, or aerosol insect sprays...
- Dress warmly.
- Keep your eyeglasses on.
- Ask questions.

...and most of all...





Enjoy the night!



*La Fin*