

Viewing and Photographing Solar Eclipses

Randall Light, MD



Viewing and Photographing Solar Eclipses

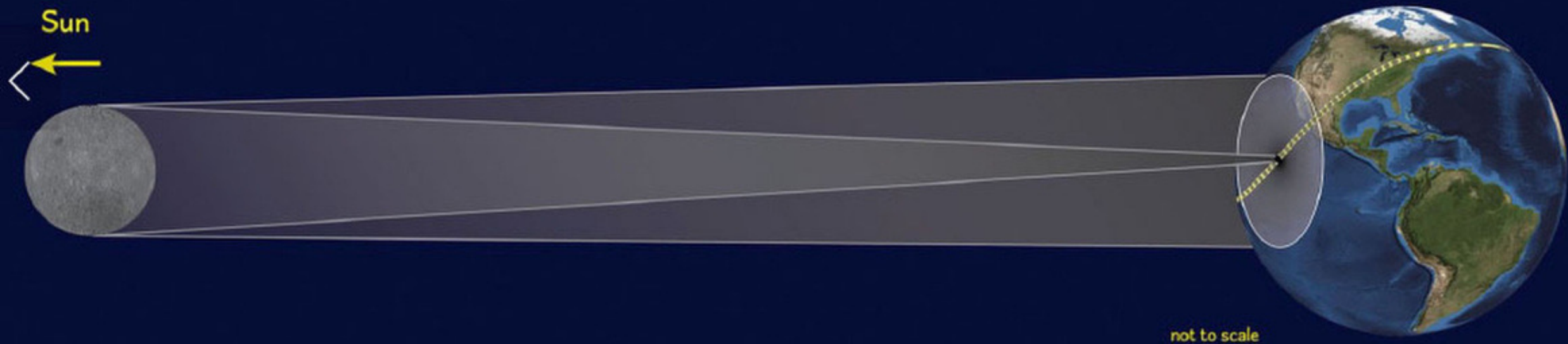
A concise presentation title "Viewing and Photographing Eclipses" will be made. Information about viewing and photographing annular and solar eclipses with a DSLR or mirrorless camera will be emphasized. Multiple options for photographing the upcoming eclipse, ranging from simple to complex, will be discussed. Topics to be considered include:

- Basic information about annular and total eclipses
- Selection of a date, time, and location based on the path of the eclipse, climate data, and topology
- Safety viewing an eclipse
- Different ways to view an eclipse with only solar glasses and other basic equipment
- Observing partial phase phenomena
- Observing interesting and unusual phenomena during totality
- Types of photos that can be made during an eclipse
- Photographic equipment requirements
- How to select a camera, lens, and image scale
- Recommended camera settings
- How to focus the camera and lens on the sun
- Timing of the phases of the eclipse
- Timing of the interesting phenomena to photograph during the eclipse
- Suggested initial exposure settings for each eclipse phase and phenomena
- How to create a composite eclipse sequence in Photoshop
- Software to help photograph the eclipse

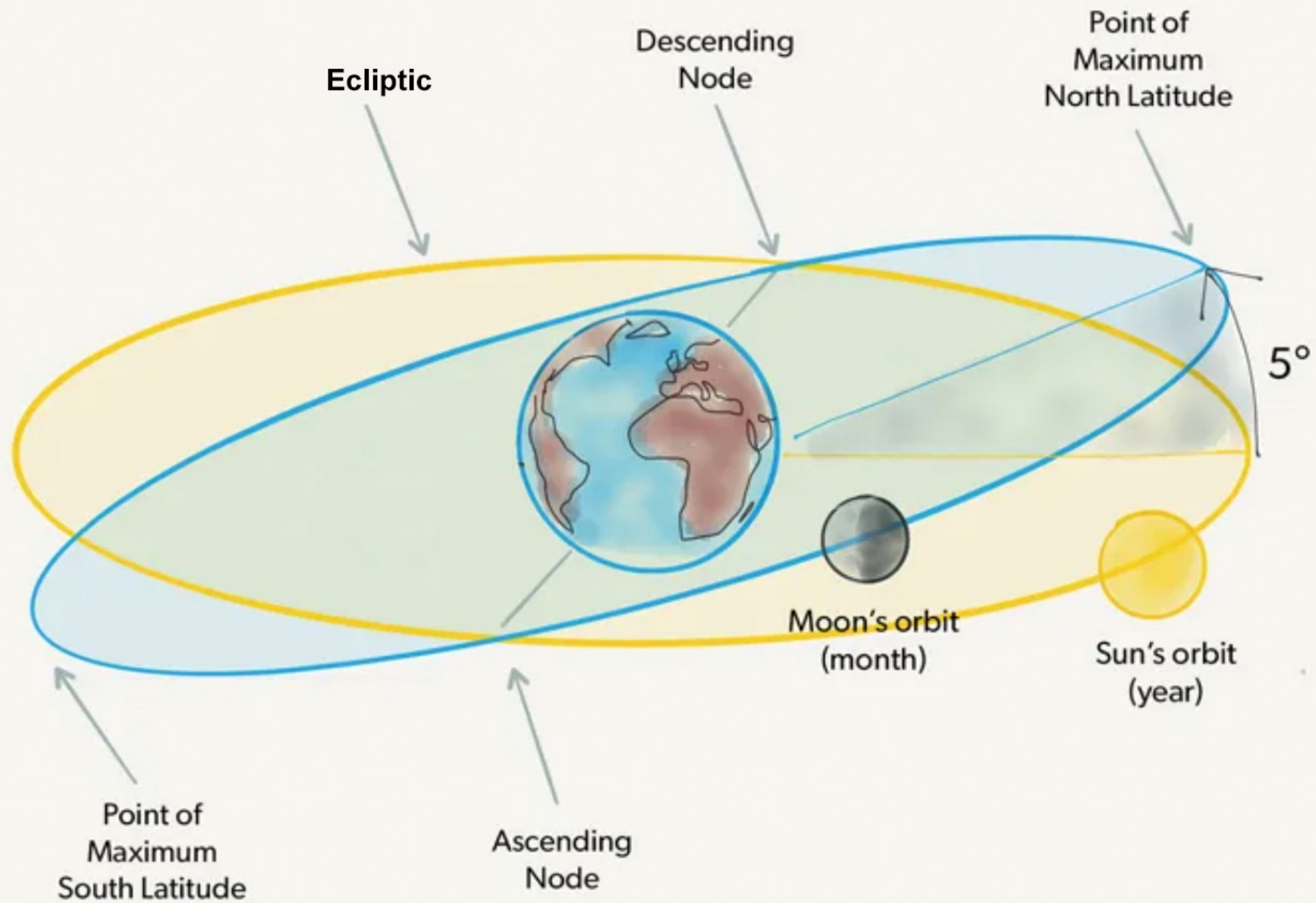


A TOTAL ECLIPSE OF THE SUN

We are fortunate for a cosmic coincidence that allows us to see the full drama of the Sun's corona; the Sun has a diameter about 400 times that of the Moon and is also about 400 times further away from Earth. That's why the Moon can neatly eclipse the Sun! Total eclipses like ours are a rare occurrence in our galaxy.



The Moon's inner shadow— the umbra — is where the total solar eclipse can be seen
The Moon's outer shadow— the penumbra — is where the eclipse is seen as partial



2023-2024 Eclipse Paths

2023 Maximum Partial Obscuration (%)

2024 Maximum Partial Obscuration (%)



The 2023 & 2024 Solar Eclipses through the eyes of NASA

Lunar topography data from NASA's Lunar Reconnaissance Orbiter and the Japan Aerospace Exploration Agency's SELENE lunar orbiter were used to precisely calculate the location of the Moon's shadow for the 2023 and 2024 solar eclipses. The planetary positions are from NASA's Jet Propulsion Laboratory Development Ephemeris 421. Earth imagery from NASA's Blue Marble: Next Generation series were used to create the terrain and Earth at night imagery from NASA's Black Marble were used under the eclipse paths.

2023 Annular Solar Eclipse Saturday, October 14, 2023
2024 Total Solar Eclipse Monday, April 8, 2024

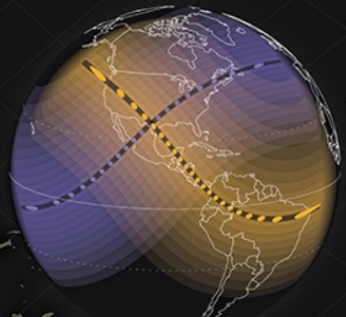
Credit: Michala Garrison and the Scientific Visualization Studio (SVS), in collaboration with the NASA Heliophysics Activation Team (NASA HEAT), part of NASA's Science Activation portfolio
 Eclipse calculations by Ernie Wright, NASA Goddard Space Flight Center

0 mi 200
 0 km 200

2023 Path of Annularity October 14, 2023
 Along a path about 125 miles wide, the Sun will appear as a "ring of fire" in the sky. Annularity lasts up to 5 minutes depending on the viewer's location within this path.

2024 Path of Totality April 8, 2024
 Along a path about 115 miles wide, the Moon will completely block the Sun in the sky. Totality lasts up to about 4 minutes and 28 seconds depending on the viewer's location within this path.

Outside of these paths, viewers within the 48 contiguous U.S. states and many other areas will see a partial solar eclipse (in the shaded areas below).

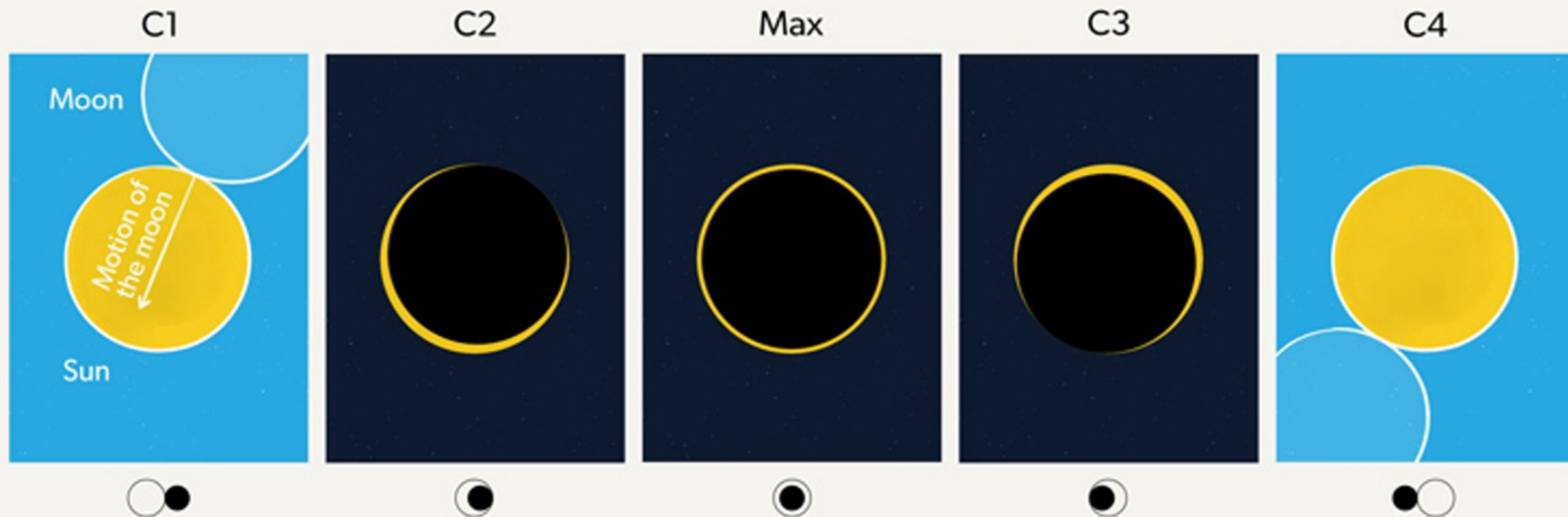


Find More: solarsystem.nasa.gov/eclipses

NP-2022-11-909-GSFC

Phases of an Annular Solar Eclipse

photopills.com



Timeline of the October 14, 2023 Annular Solar Eclipse



about an hour and 15 minutes
of partial solar eclipse

up to 4 to 5 minutes of
annular solar eclipse

about an hour and 15 minutes
of partial solar eclipse

Michael Zeiler, GreatAmericanEclipse.com





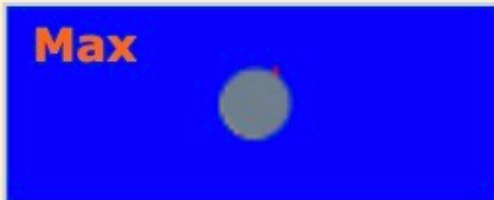
30° 42' 08.33" N <—> 30.70232°
96° 21' 31.55" W <—> -96.35876°
108.0m (354ft)

Penumbral duration : 2h 40m 45.6s
(partial solar eclipse)

[Help](#)

Obscuration : 98.842%

Max



Magnitude at maximum : 0.98454
Moon/Sun size ratio : 1.05610

Event ($\Delta T=69.1s$; alt.=108m)	Date	Time (UT)	Alt	Azi	P	V
Start of partial eclipse (C1) :	2024/04/08	17:20:08.3	+62.1°	142.4°	229°	03.3
Maximum eclipse (MAX) :	2024/04/08	18:40:05.3	+66.7°	188.2°	317°	01.6
End of partial eclipse (C4) :	2024/04/08	20:00:53.9	+58.2°	228.4°	046°	11.8

29° 30' 41.42" N <--> 29.51150°
99° 41' 39.77" W <--> -99.69438°
432.0m (1417ft)

Umbral depth : 87.75% (85.0km)
11.9km (7.4mi)
Path width : 193.8km (120.4mi)
Obscuration : 100.00%



4m 24.4s (total solar eclipse)
4m 23.3s (lunar limb corrected)

[Help](#)

Magnitude at maximum : 1.02470
Moon/Sun size ratio : 1.05629
Umbral vel. : 0.719km/s (1608 mph)

Event ($\Delta T=69.1s$; alt.=432m)	Date	Time (UT)	Alt	Azi	P	V	LC
Start of partial eclipse (C1) :	2024/04/08	17:12:56.6	+59.9°	132.5°	226°	03.0	
Start of total eclipse (C2) :	2024/04/08	18:30:17.3	+68.0°	173.3°	053°	10.0	-0.4s
Maximum eclipse (MAX) :	2024/04/08	18:32:29.5	+68.0°	174.8°	316°	01.3	
End of total eclipse (C3) :	2024/04/08	18:34:41.7	+68.0°	176.2°	219°	04.6	-1.5s
End of partial eclipse (C4) :	2024/04/08	19:53:53.9	+62.1°	221.9°	047°	11.6	

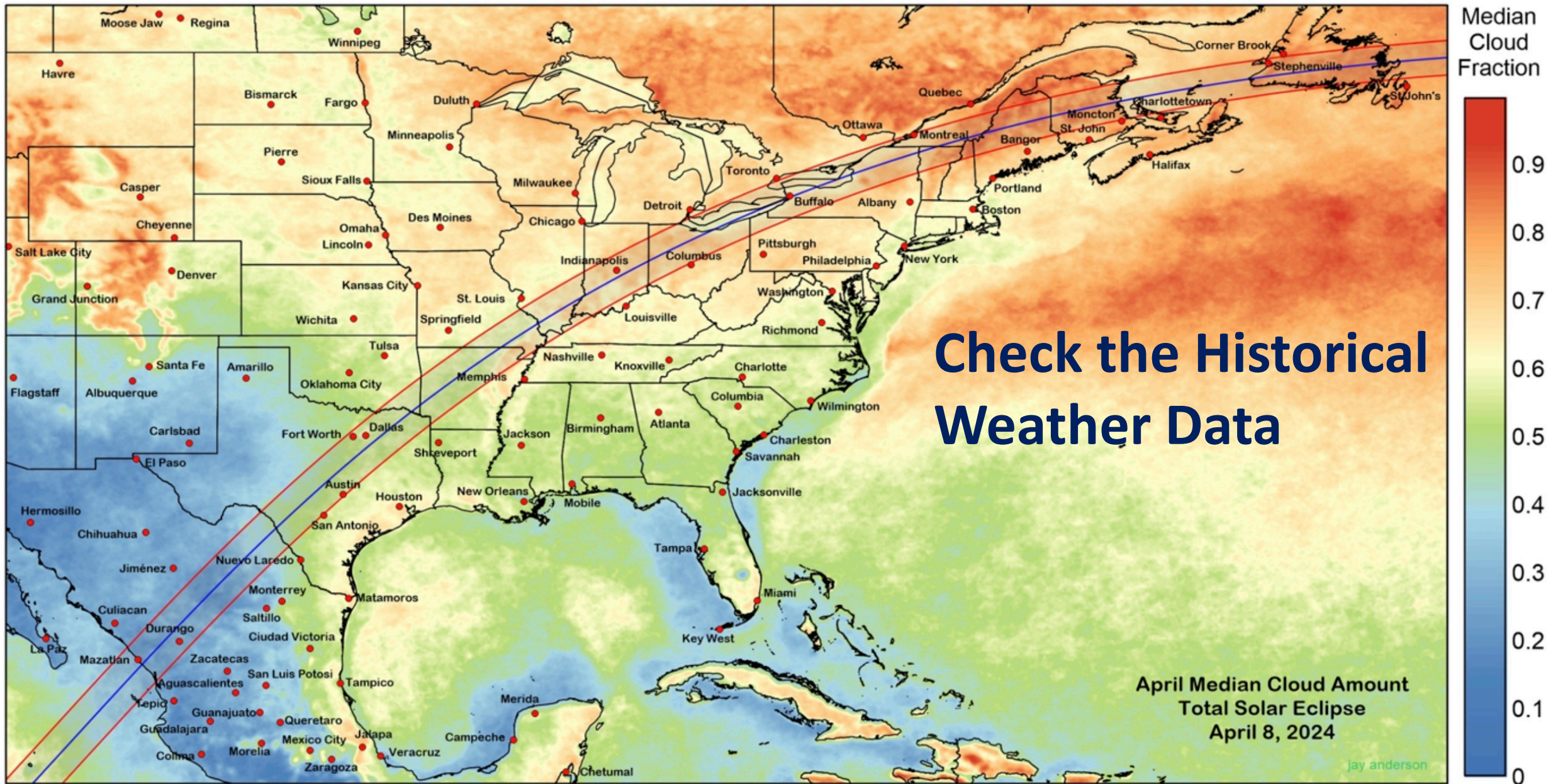


Figure 3: Average April (2000-2020) cloud cover measured from the Aqua spacecraft at approximately 1330 local time from 2000 to 2020. Data: NASA. Eclipse track: Fred Espenak.

The Impact of El Niño

<https://eclipsophile.com/>

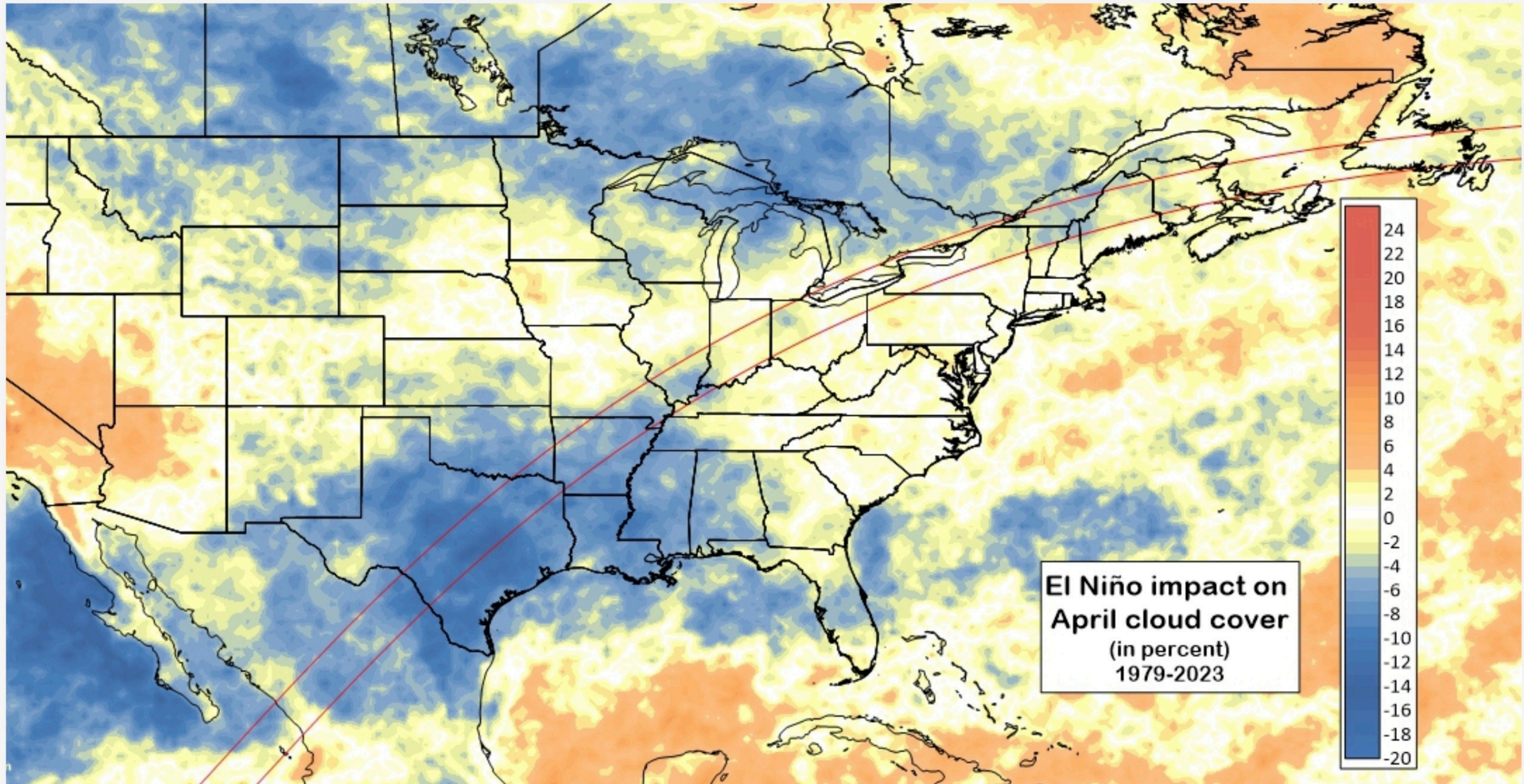
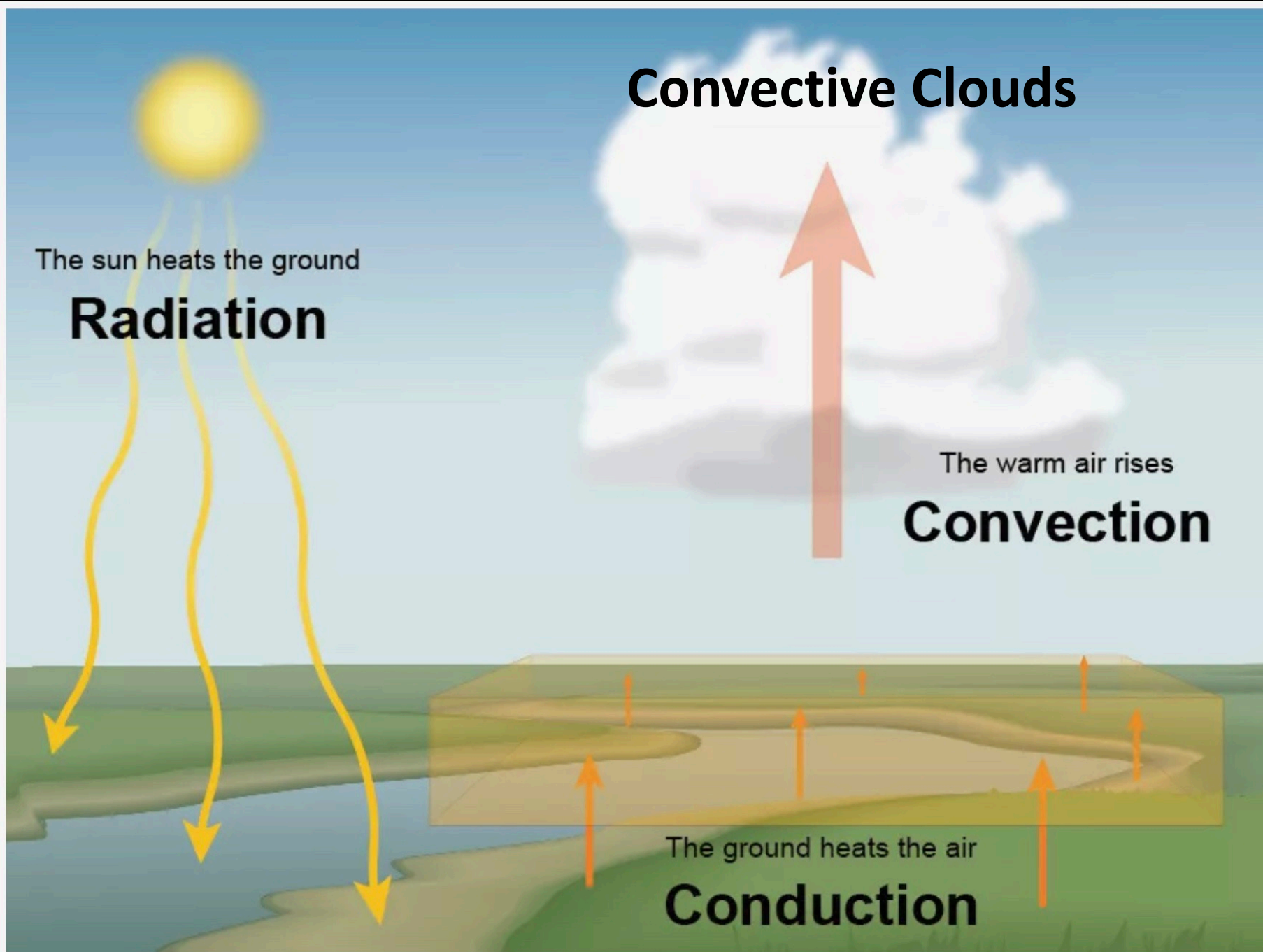
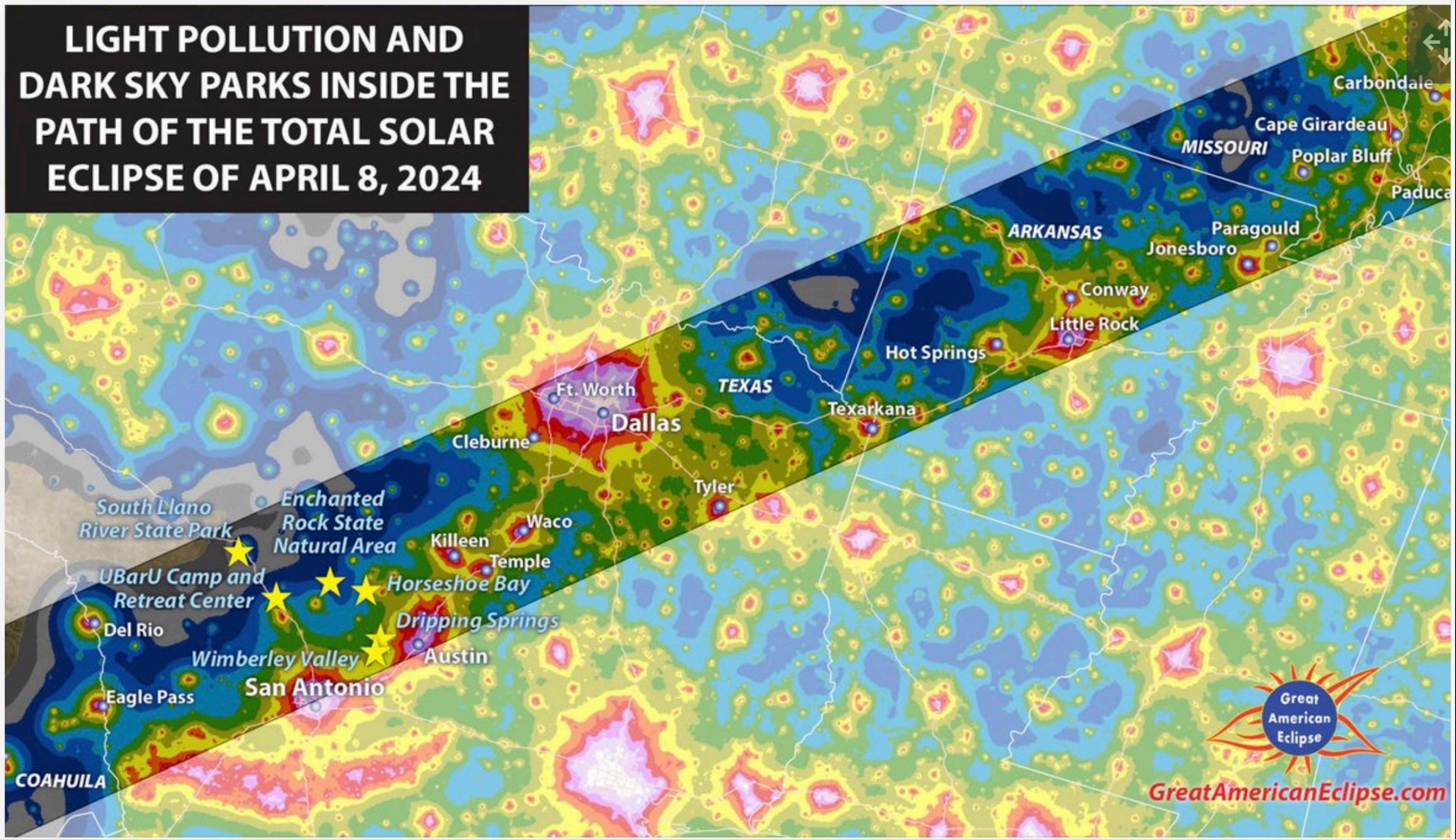


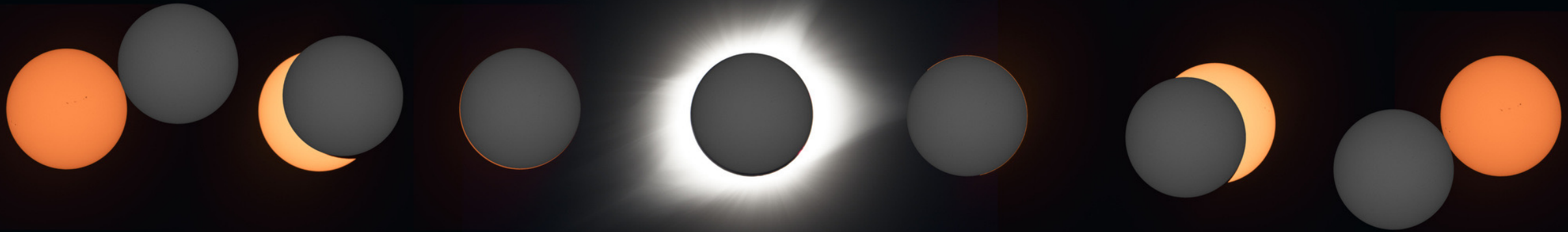
Figure 4a: Map showing the impact of El Niño on April cloud cover along the eclipse track. Blue tones indicate a lower amount of cloud; white and pale yellow



LIGHT POLLUTION AND DARK SKY PARKS INSIDE THE PATH OF THE TOTAL SOLAR ECLIPSE OF APRIL 8, 2024



Total Solar Eclipse Phases



C1

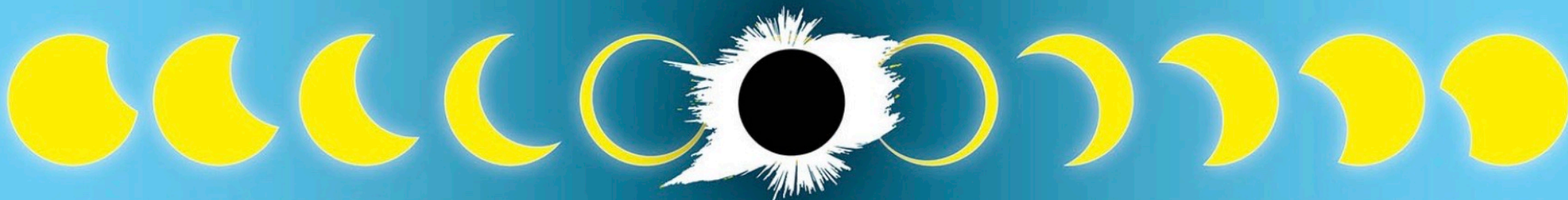
C2

Max

C3

C4

Timeline of the April 8, 2024 Total Solar Eclipse



about an hour and 15 minutes
of partial solar eclipse

up to four minutes and
27 seconds of totality

about an hour and 15 minutes
of partial solar eclipse

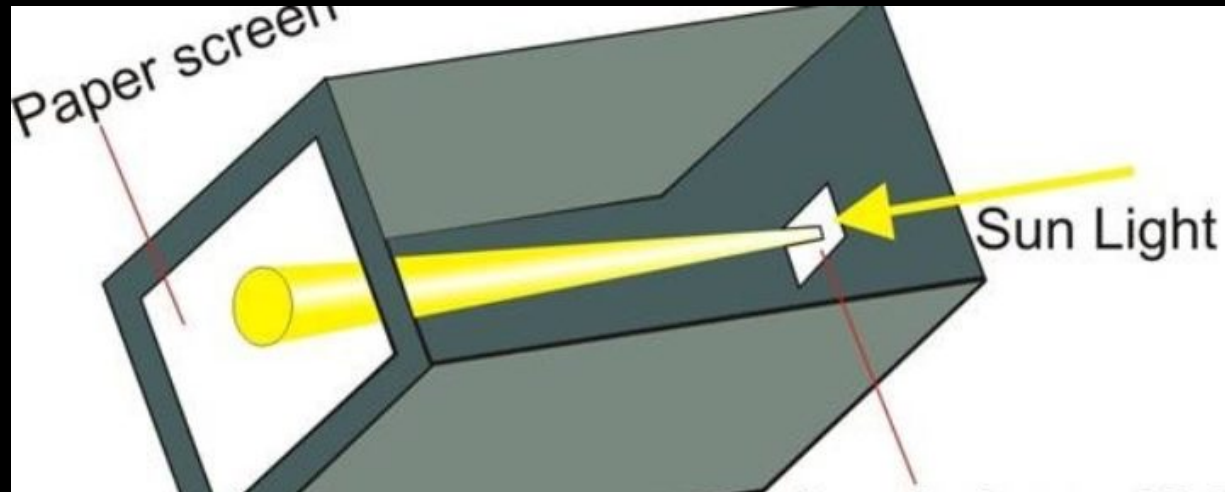
Michael Zeiler, GreatAmericanEclipse.com

How to View an Eclipse

Pinhole Camera



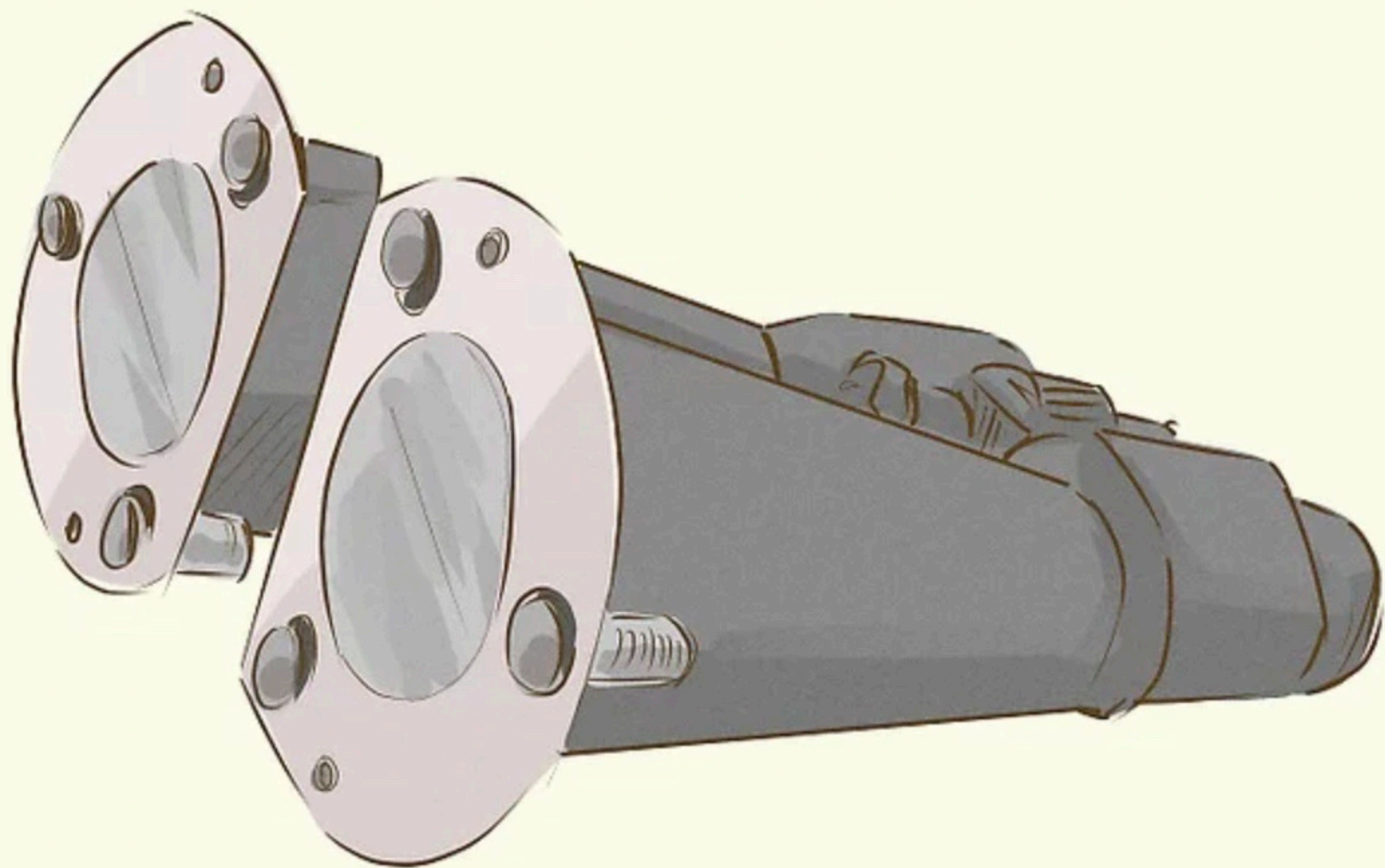
Pinhole Projector



Protect Your Vision!

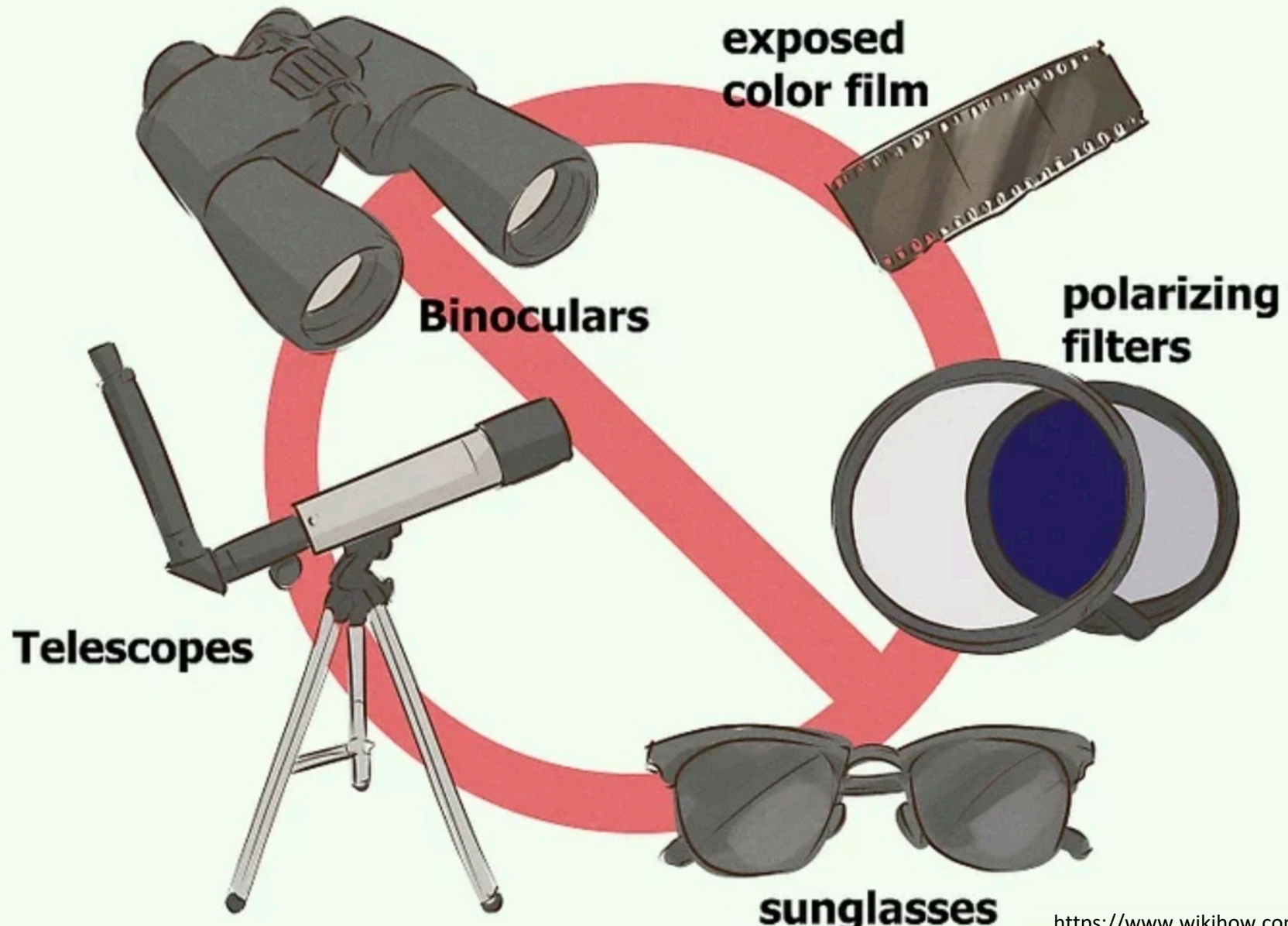
If you are going to look at the sun, you must use solar glasses or a solar filter to protect your eyes from damage!







<https://www.wikihow.com>



**exposed
color film**

Binoculars

**polarizing
filters**

Telescopes

sunglasses

<https://www.wikihow.com>

Safety First! Protect Your Vision and Equipment

• According to NASA, the following materials should **never** be used to view a solar eclipse:

- Photographic neutral density filters, no matter how dense they are
- Photographic polarizing filters
- Sunglasses of any kind
- Negative film (exposed or not)
- Smoked glass
- Space blankets and other forms of household Mylar, or silvery CD/DVD disks
- Medical X-ray film
- Floppy disks

You must avoid these materials because, although they dim visible light, **they do not block infrared (IR) and ultraviolet (UV) light that can damage your retinas or equipment.**

Use a Solar Filter

What Can Be Seen Or Observed Without Special Equipment?

Interesting Partial Phases Phenomena C1-C2

T-45 -> T-5: Projected Crescents

T-45 -> T-5: Sharp and Fuzzy Shadows

T-15 -> T-1: Dim Steely Metallic Light.

T-15 -> T-1: The air will become cooler (8-12°F). The light will be dimmer.

T-15 -> T-1: Bird become quieter. Crickets may start chirping.

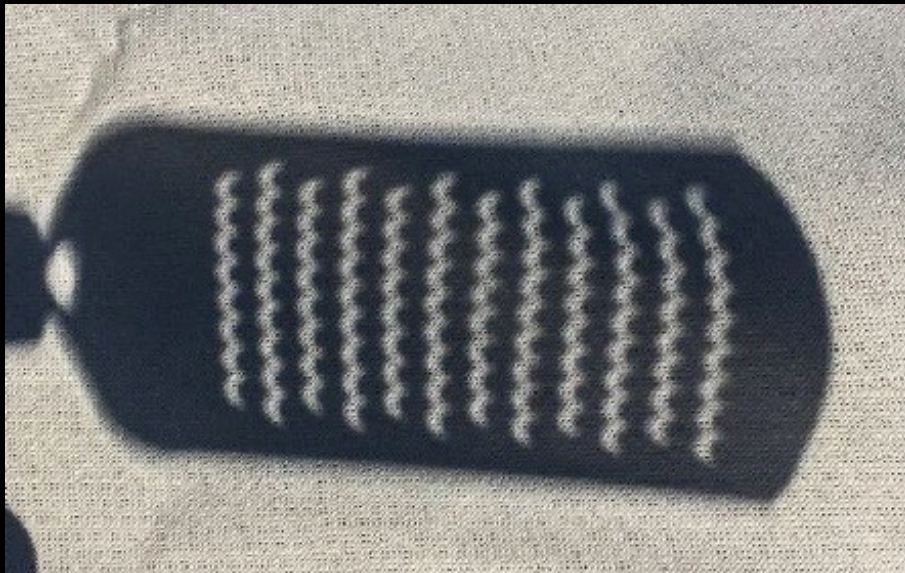
Bees return to their hive. Farm animals stop grazing.

T-5 -> T-1: Rapid Dimming and the Purkinje Effect (Desaturation)

T-2 -> T-1: Shadow Bands

Interesting Partial Phases Phenomena

T-45 -> T-5: Projected Crescents



T-45 -> T-5: Sharp and Fuzzy Shadows

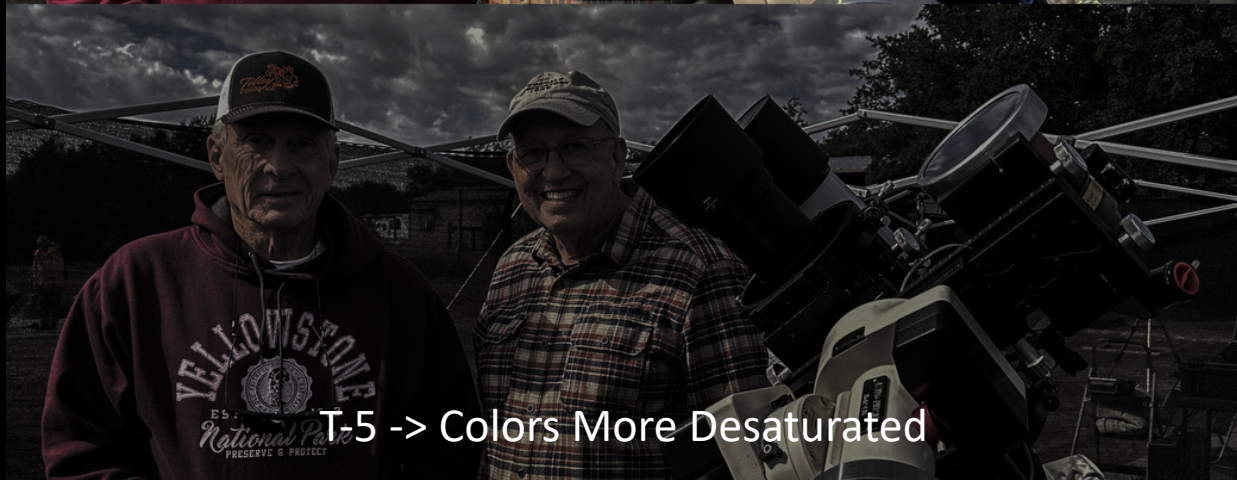




Simulated Purkinje Effect Near Totality

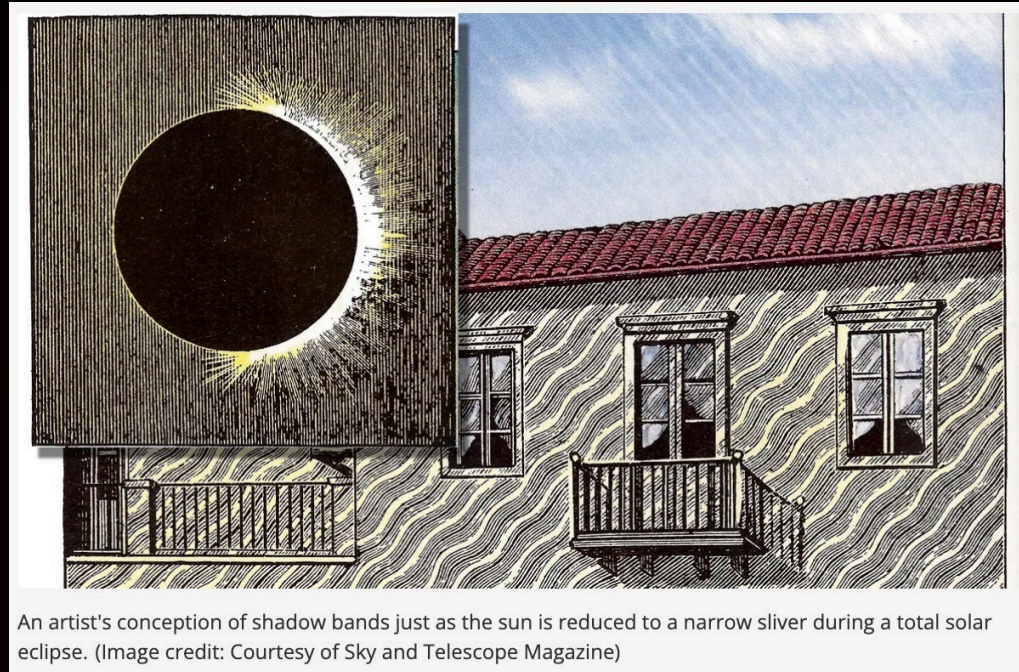


T-15 -> T-1: Dim Steely Metallic Light. Color desaturation



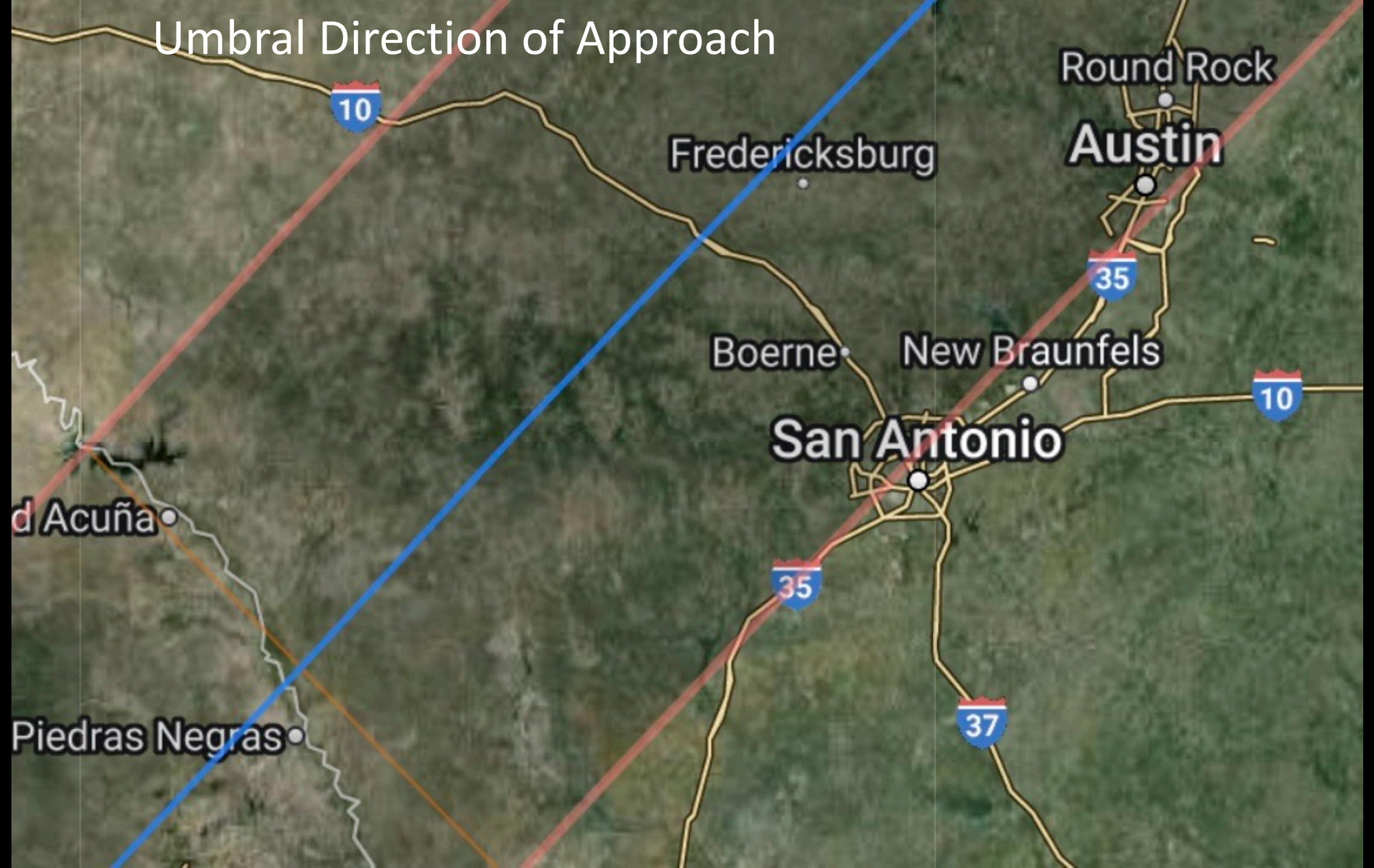
T-5 -> Colors More Desaturated

Interesting Partial Phases Phenomena



T-2 -> T-1: Shadow bands may appear. These are shimmering or rippling bands of light caused by atmospheric turbulence.

Umbral Direction of Approach

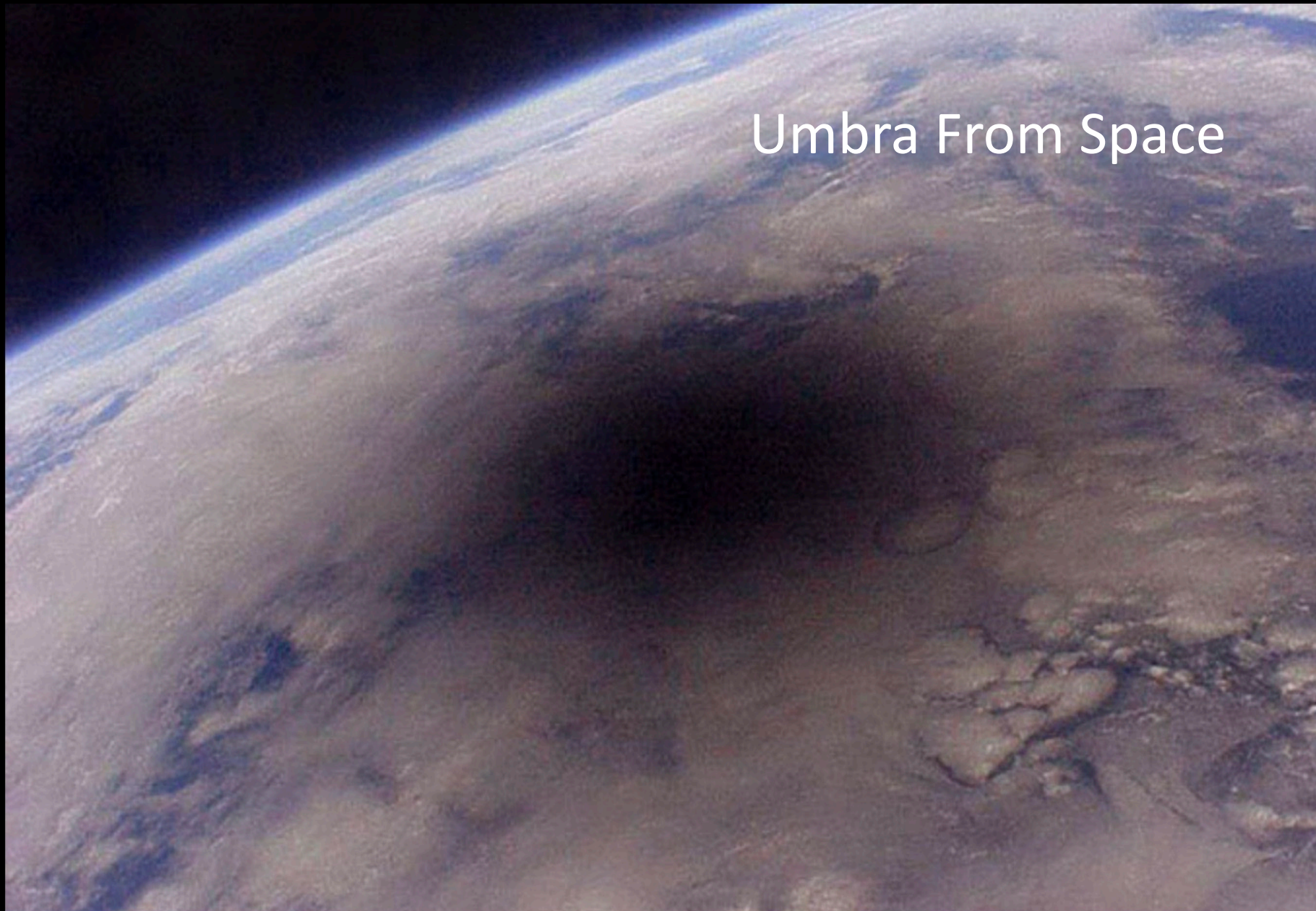




The Umbra Approaches

APOD [Daniel Fischer](#) ([Cosmic Mirror](#))

Umbra From Space



Centre National d'Etudes Spatiales (CNES)

The first-ever astronaut's view of the moon's shadow cast on the Earth during a total solar eclipse on Aug. 11, 1999.

Total Solar Eclipse April 8, 2024

Time of totality

12:23:47 pm CST

Duration of totality

4 min 28 sec

Speed of Moon's shadow

1,576 mph

Width of path of totality

121.3 miles



Coahuila



00:40 / 03:26

Eclipse Ground Track

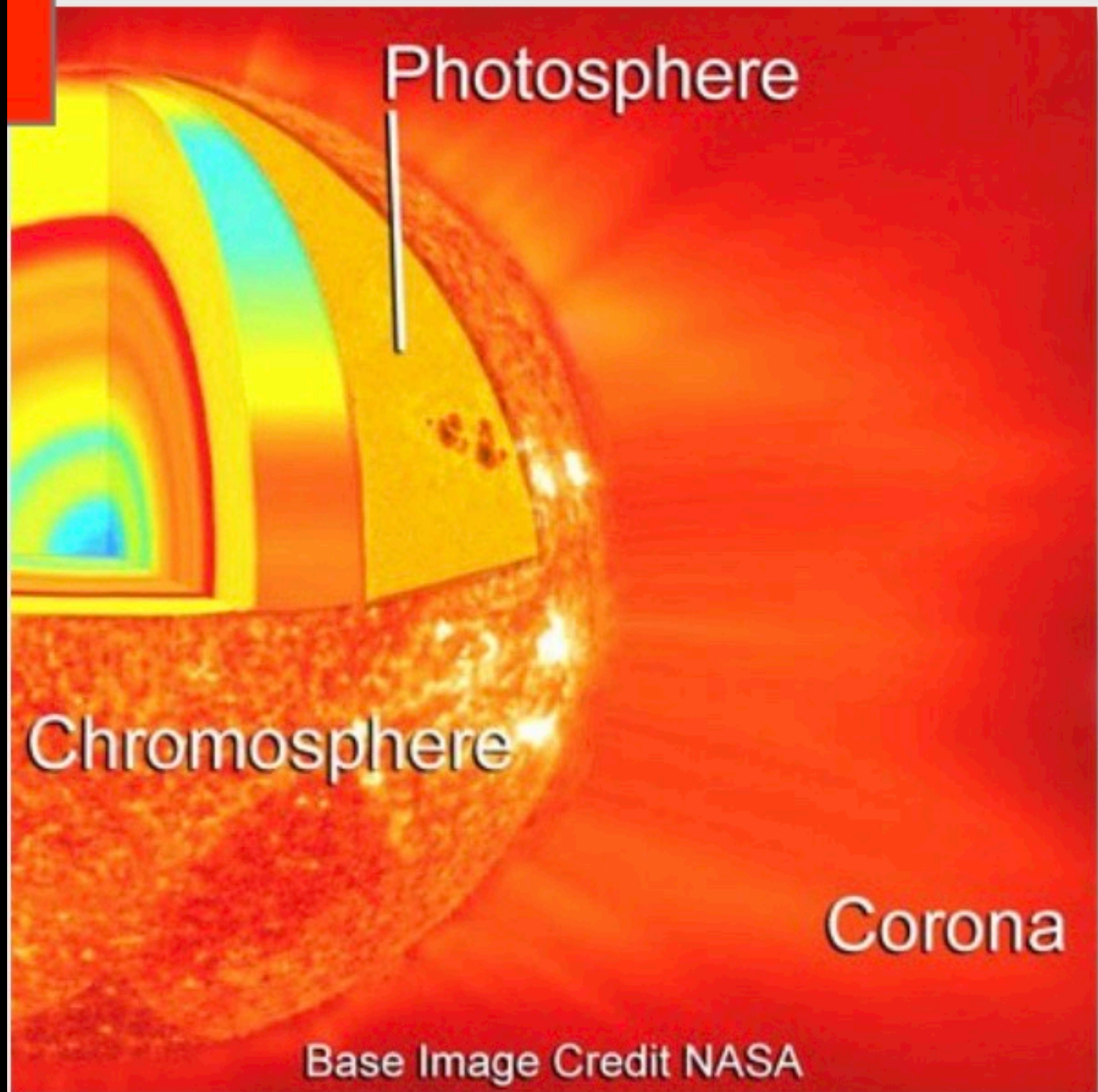


GreatAmericanEclipse.com

Solar Corona

Close-Up Tracked Image
With Bracketed Slow
Exposures





Photosphere

Chromosphere

Corona

Base Image Credit NASA

Photosphere

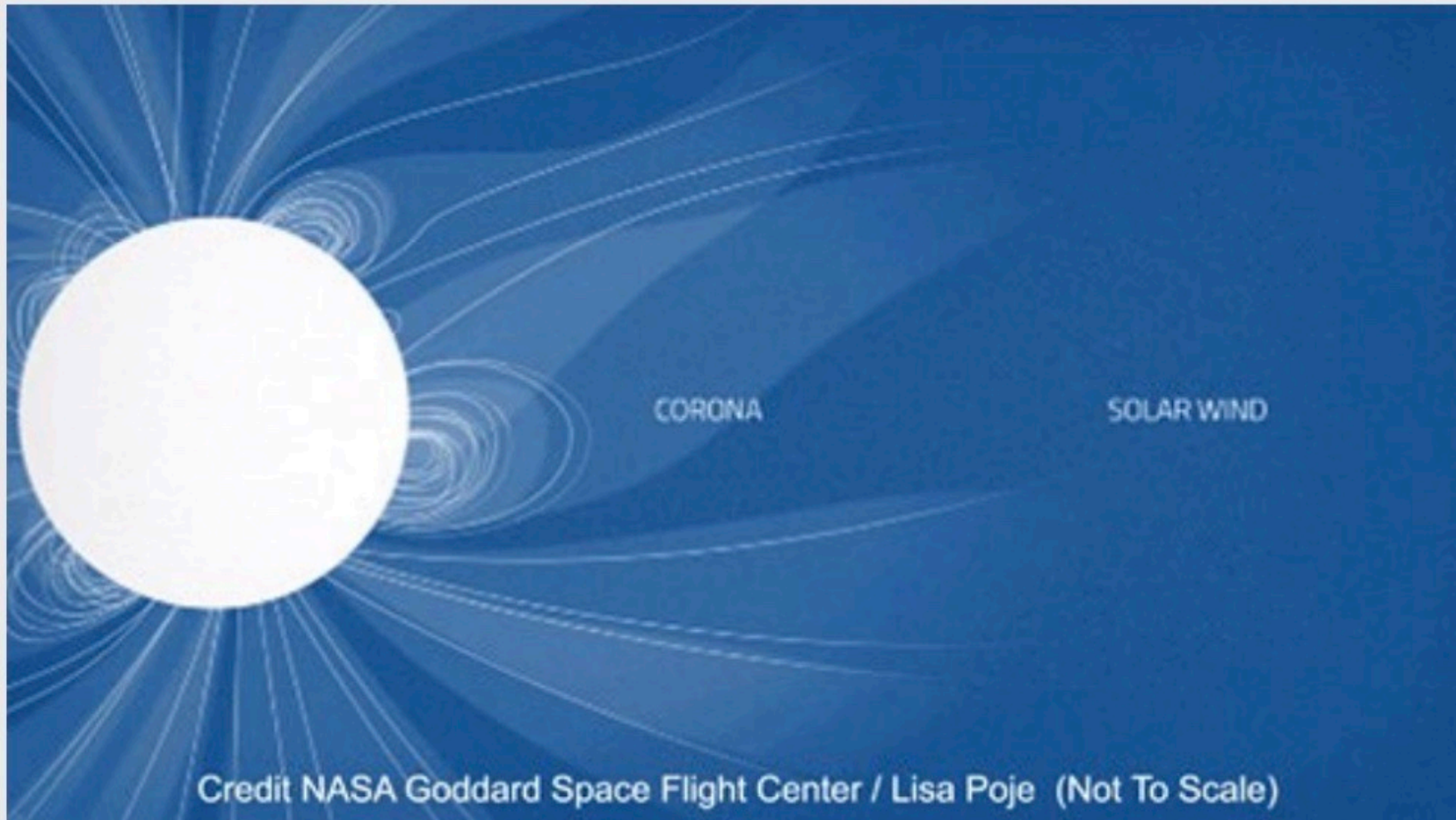
~5,500° C

Chromosphere

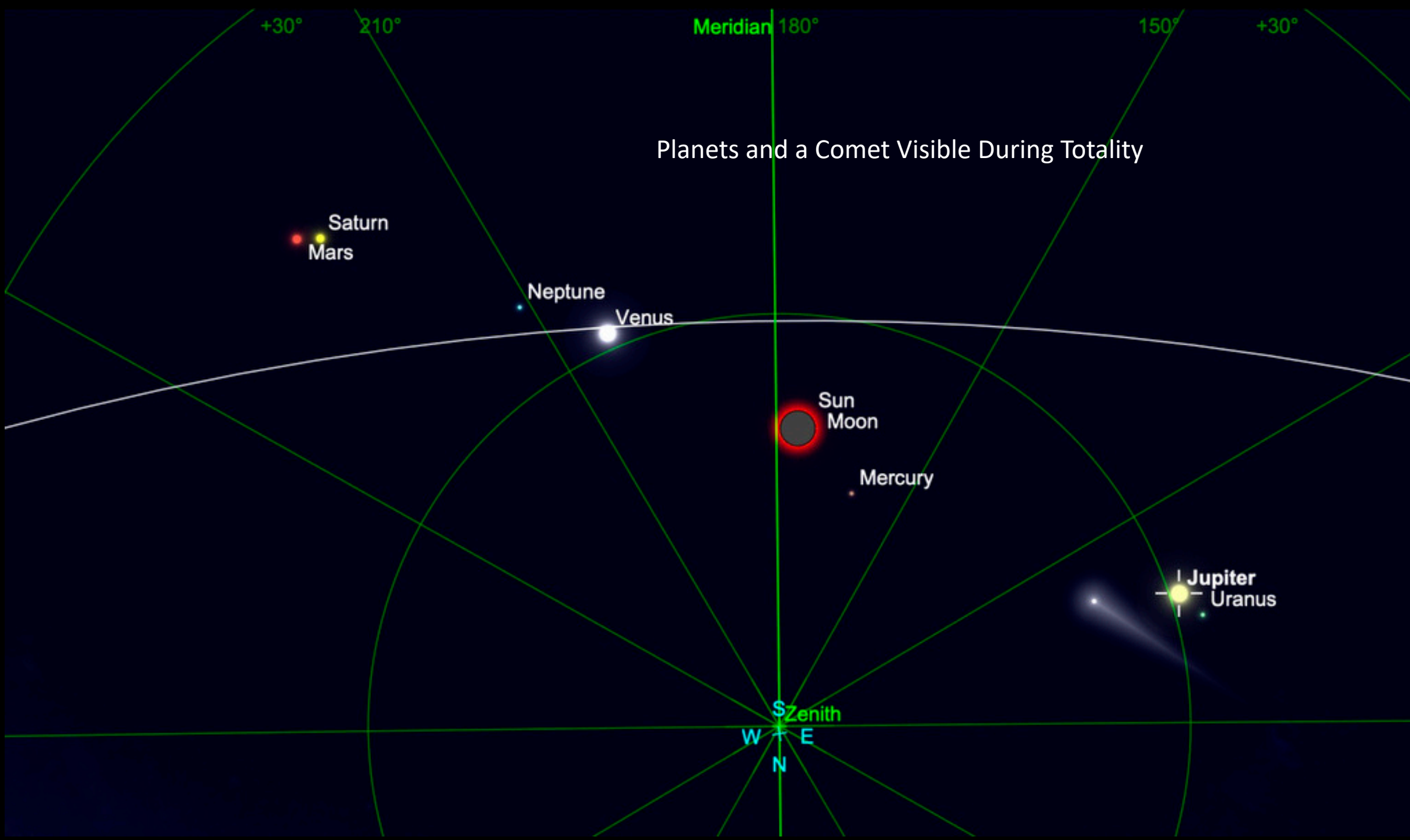
~ 4,300° C

Corona

Millions of
degrees C



The solar wind eventually reaches Earth. Particles traveling through space drawn to the Earth's magnetic fields cause the northern and southern aurora. Coronal mass ejections from solar flares can send enough plasma and radiation to Earth to affect communications and the electrical grid.



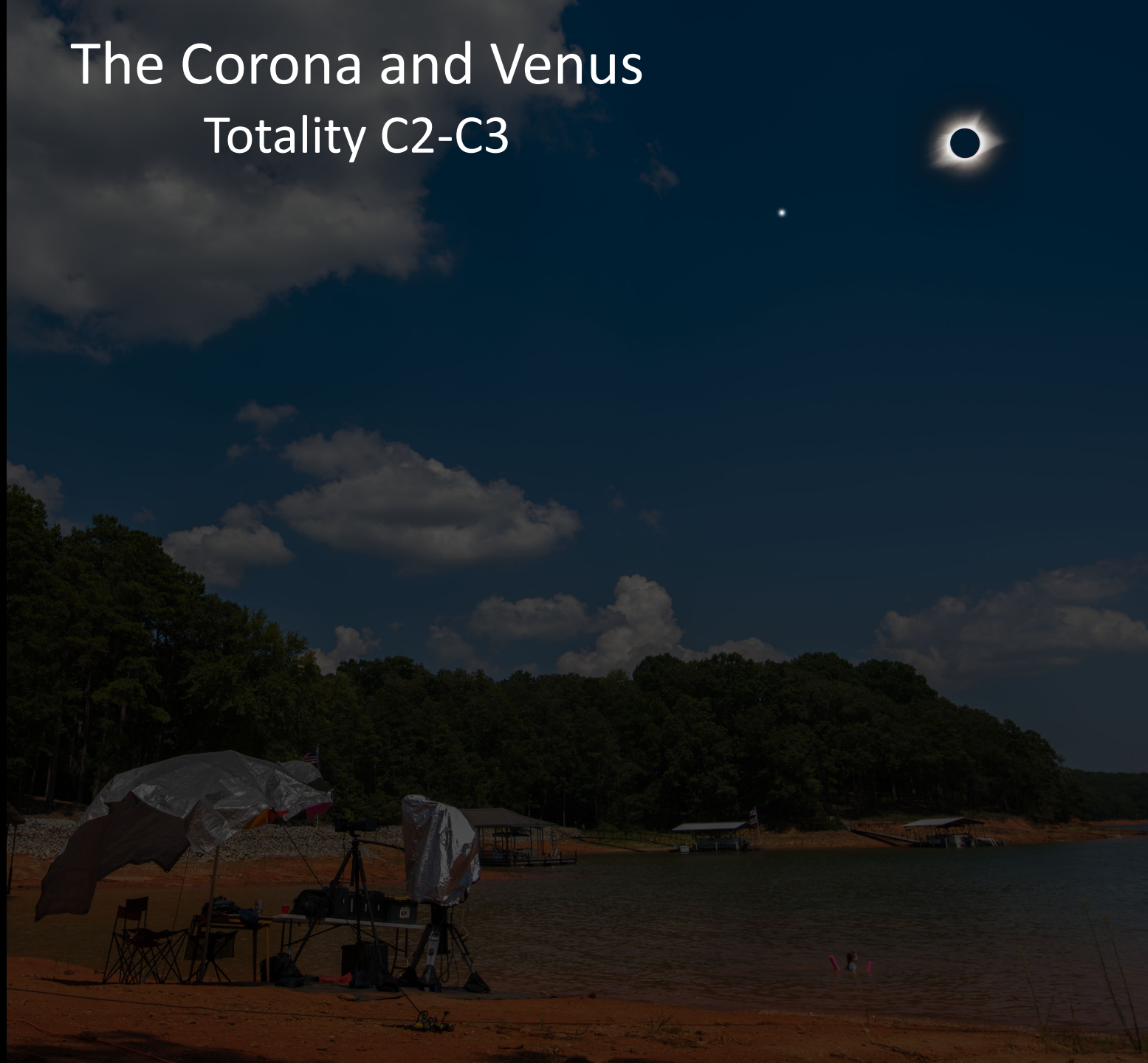
The Corona and Venus Will Be Visible at Totality
on April 8, 2024.

Venus



The Corona and Venus

Totality C2-C3





360° Horizon Glow

[Yuri Beletsky](#)

APOD

What Kind of Eclipse Pictures Can I Make?



Wide Field Images

Wide Field Layered Composites

Close-Up Single Telephoto Images

Close-Up Multiple Telephoto Layered Composites

Wide Field Scene Photo



Each type of image requires an equipment and exposure plan.

DSLR or Mirrorless Camera
Wide Angle Lens

Position the Camera at or Beyond the Hyperfocal Distance
Tripod

Autofocus on the Horizon
Autoexposure on the Sky Glow

Landscape With Wide Angle Lens



Nikon D4s | 18mm | f/16 | 10s | ISO 100 | 5850K

Multi-Photo Composite



Nikon D7000 | 17mm | f/8 | ISO 100 | 5000K
Solar eclipse base photo: 1.3s
Partial eclipse pictures: 1/25s | Solar filter

Close-Up Single Telephoto Image With a Solar Filter

Equipment:

- Tripod
- Camera of Choice
- Lens for Image Scale
of 1-3 arc-sec/pix
- Solar Filter
- Cable Release

Image Exposure:

- ISO 200
- 1/1000 sec.
- Bracket ± 1 stop. 1/500, 1/1000, & 1/2000.
- f/8

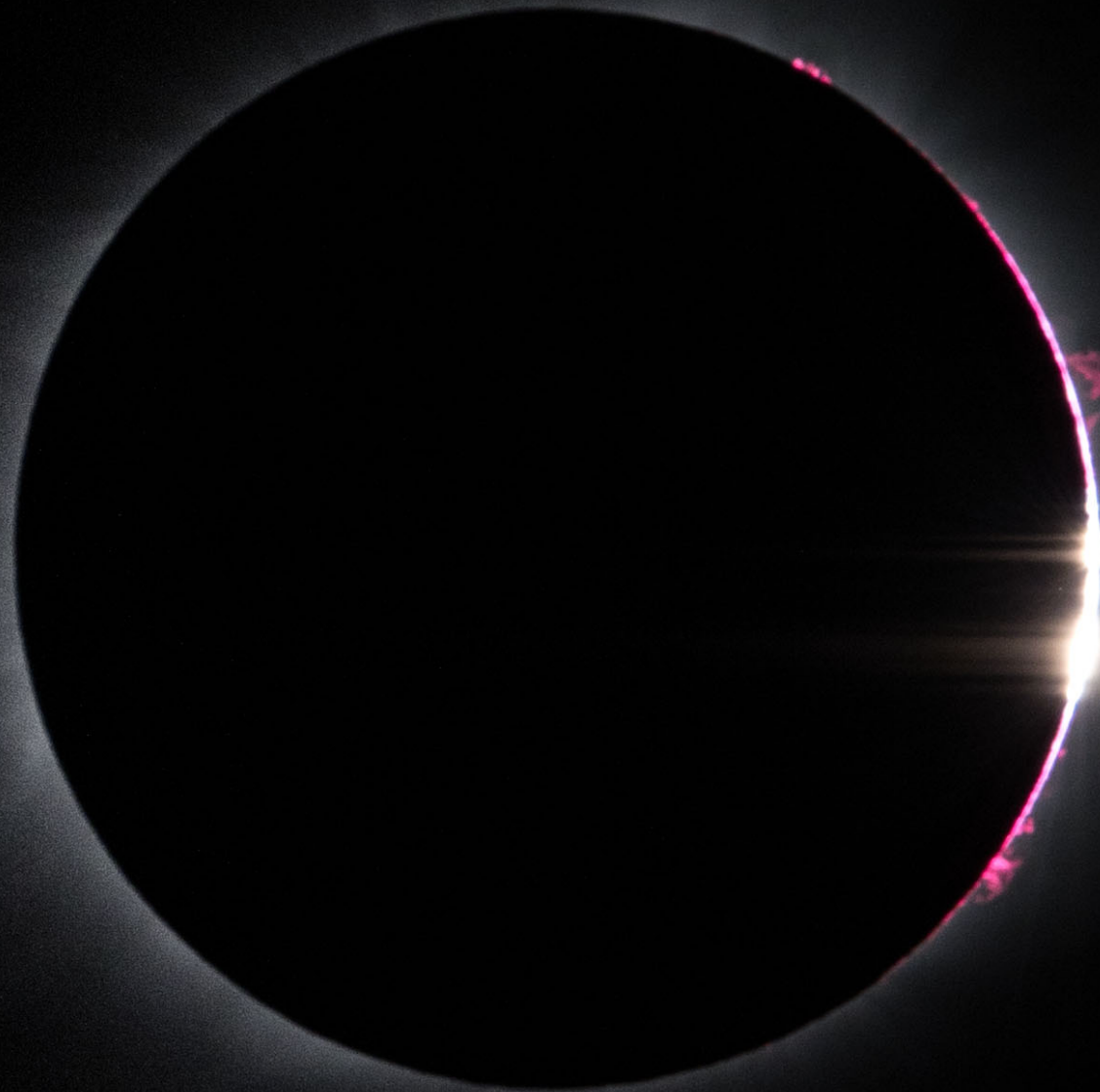


Diamond Ring Effect

Close-Up Tracked Image With Bracketed Fast Exposures



Close-Up Tracked Image With Bracketed Fast Exposures



Chromosphere

Solar Prominence

Bailey's Beads

Solar Prominence

Solar Corona

Close-Up Tracked Image
With Bracketed Slow
Exposures





Earthshine

Close-Up Tracked
Image With Bracketed
Very Slow Exposures

Photography Gear



Solar Filter & Solar Glasses

Tripod, Tracker or a
Tracking Telescope Mount

Camera:

Full Frame DSLR or Mirrorless
Crop Sensor DSLR or Mirrorless
Dedicated Astrophotography, or
Cell Phone Camera
Memory Cards
Extra Batteries or External Power

Telescope:

500mm-1500mm

Camera Lens:

35mm to 800mm

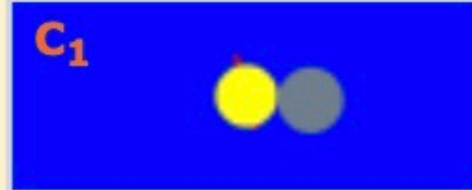
Cable Release or Intervalometer

29° 31' 01.67" N <—> 29.51713°
99° 42' 16.36" W <—> -99.70454°
421.0m (1381ft)

4m 24.8s (total solar eclipse)
4m 23.6s (lunar limb corrected)

[Help](#)

Umbral depth : 88.93% (86.2km)
10.7km (6.7mi)
Path width : 193.8km (120.4mi)
Obscuration : 100.00%



Magnitude at maximum : 1.02503
Moon/Sun size ratio : 1.05629
Umbral vel. : 0.719km/s (1608 mph)

Event ($\Delta T=69.1s$; alt.=421m)	Date	Time (UT)	Alt	Azi	P	V	LC
Start of partial eclipse (C1) :	2024/04/08	17:12:56.4	+59.9°	132.5°	226°	03.0	
Start of total eclipse (C2) :	2024/04/08	18:30:16.7	+67.9°	173.3°	053°	10.1	-0.3s
Maximum eclipse (MAX) :	2024/04/08	18:32:29.0	+68.0°	174.7°	316°	01.3	
End of total eclipse (C3) :	2024/04/08	18:34:41.5	+68.0°	176.2°	220°	04.6	-1.5s
End of partial eclipse (C4) :	2024/04/08	19:53:53.4	+62.1°	221.9°	047°	11.6	

Solar Filters



There are three types of solar filters for photography:

- Aluminized Mylar®
- Metal-coated
- Black-polymer (usually hand-held)



Camera Selection

- Full Frame or Crop Sensor Camera
- DSLR or Mirrorless Camera
- Selectable P, A, S, M Settings
- Autofocus On/Off
- Select Focus Point
- Set Exposure Point
- Exposure Compensation
- Raw Image Files
- Internal or External Intervalometer
- Continuous Release Mode
- Exposure Bracketing



Pick A Lens Based on the Field of View



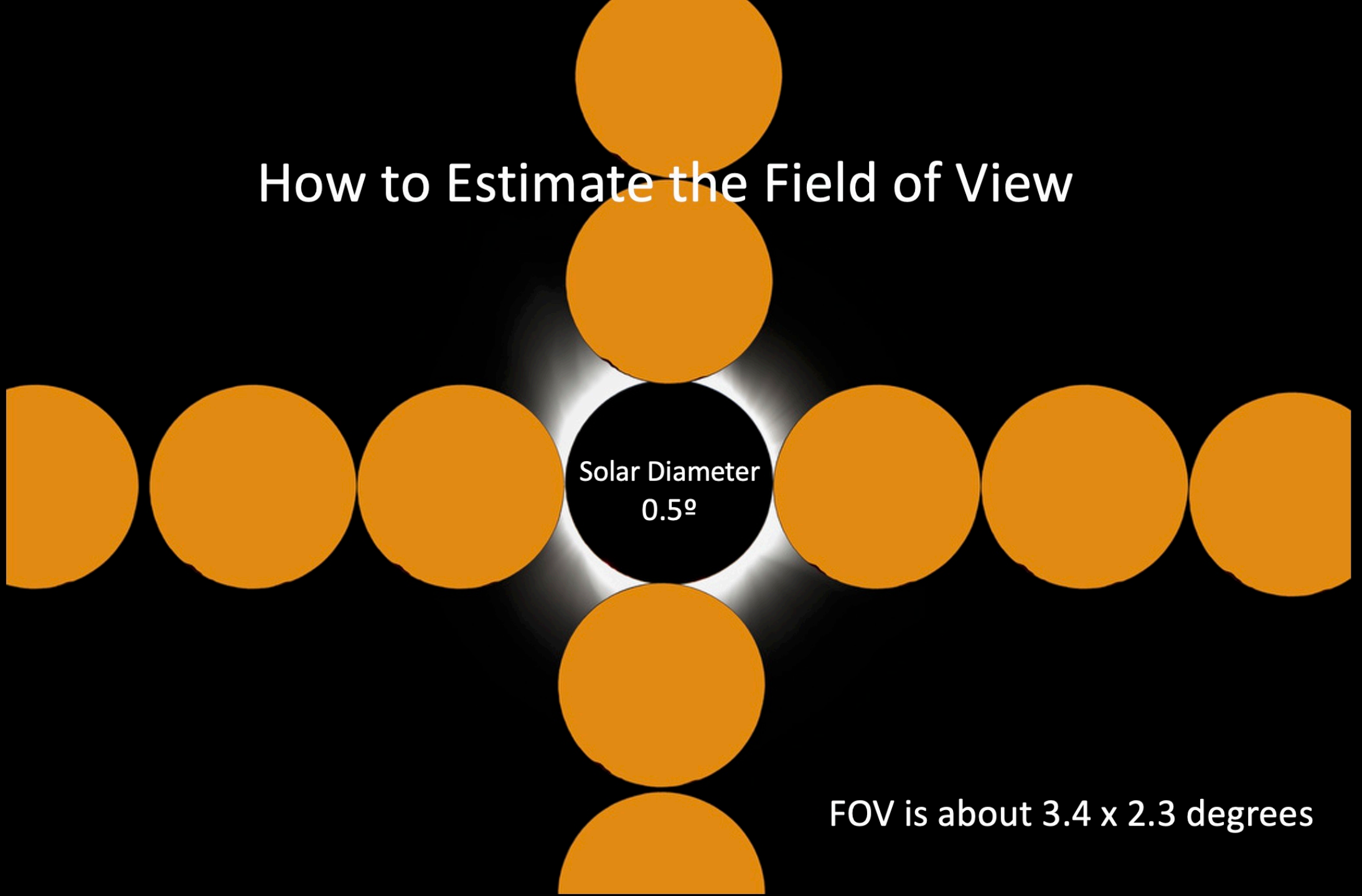
Low Sunspot Activity



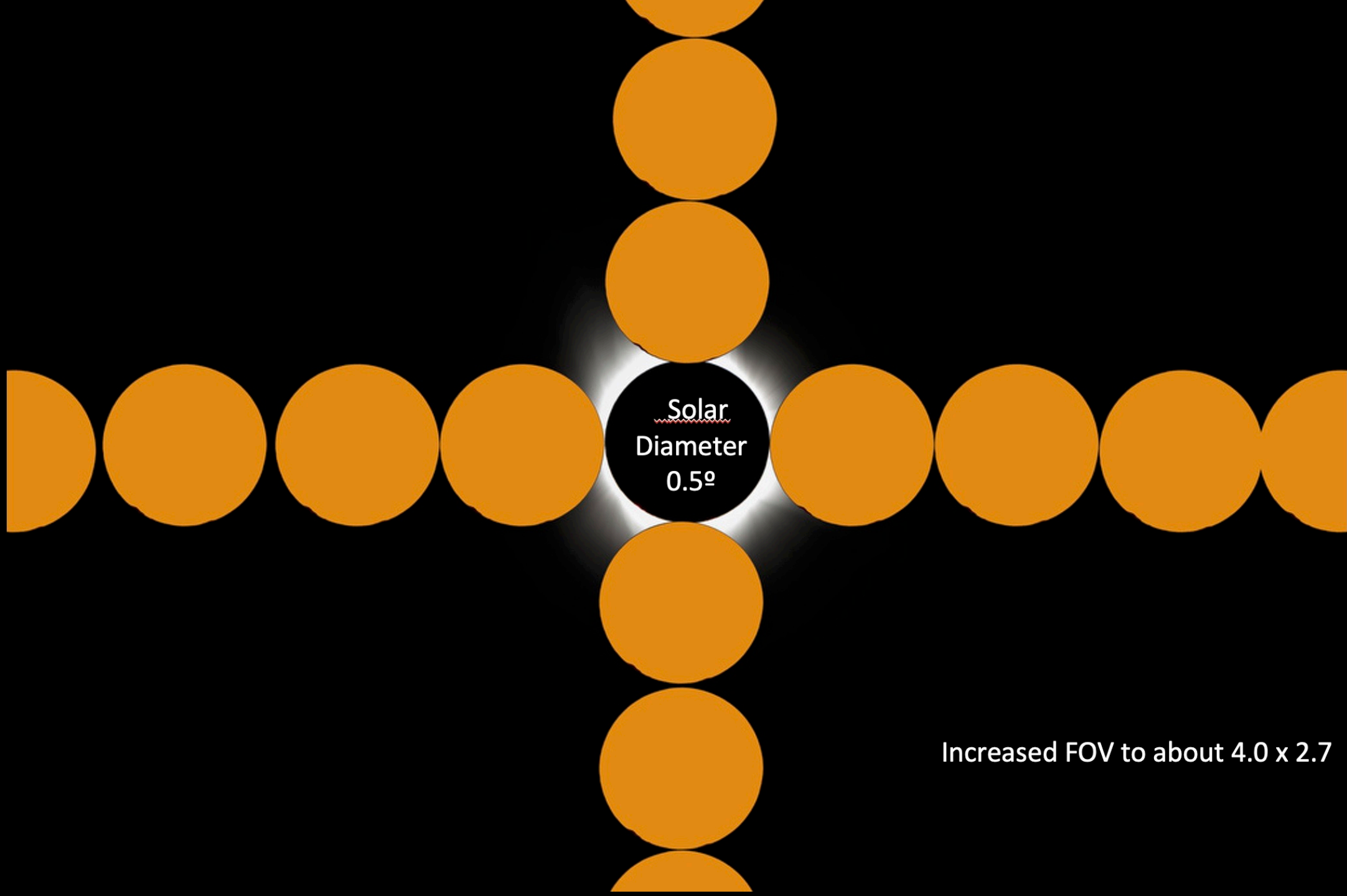
High Solar Activity

Coronal Shape and Size

How to Estimate the Field of View



FOV is about 3.4 x 2.3 degrees



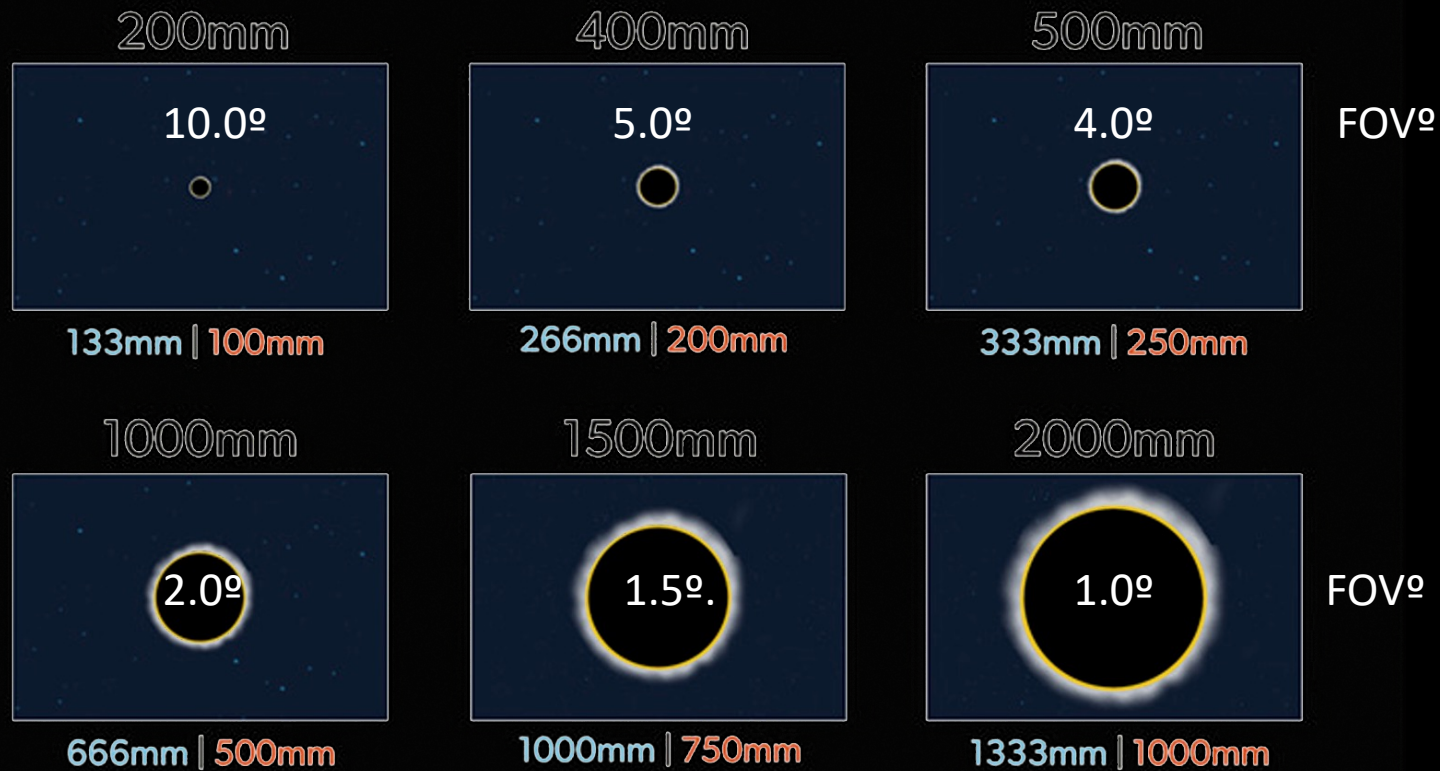
Solar
Diameter
0.5°

Increased FOV to about 4.0 x 2.7

Lens/Telescope Selection

Field of View

Focal Length vs Eclipse Size



Focal length for Full Frame | APS-C | Micro 4/3

Lens/Telescope Selection

Image Scale

Focal Length vs Eclipse Size



Focal length for Full Frame | APS-C | Micro 4/3

Calculate the resolution in arc seconds per pixel of a CCD with a particular telescope.

Resolution Formula: (Pixel Size / Telescope Focal Length) X 206.265

Add New Equipment To Database

Telescope:	<input type="text" value="Custom Scope"/>	Focal Length:	<input type="text" value="500"/> <input type="text" value="mm"/>	Barlow / Reducer:	<input type="text" value="None"/>
Camera:	<input type="text" value="Nikon - Z7"/>	CCD Pixel Size	<input type="text" value="4.34"/> <input type="text" value="µm"/>	CCD Binning	<input type="text" value="1x1"/>
Seeing	<input fwhm)"="" type="text" value="OK Seeing (2-4\"/>			= Resolution:	<input type="text" value="1.79"/> <input pixel"="" type="text" value="\"/>

The ideal pixel size for OK Seeing (2-4\" FWHM) seeing is: 0.67 - 2\" / pixel.



What are the camera
settings?



Fixed Camera Settings

- High ISO Noise Reduction—Off
- Long Exposure Noise Reduction—Off
- Picture Control—Normal
- White Balance—Daylight; Direct Sun



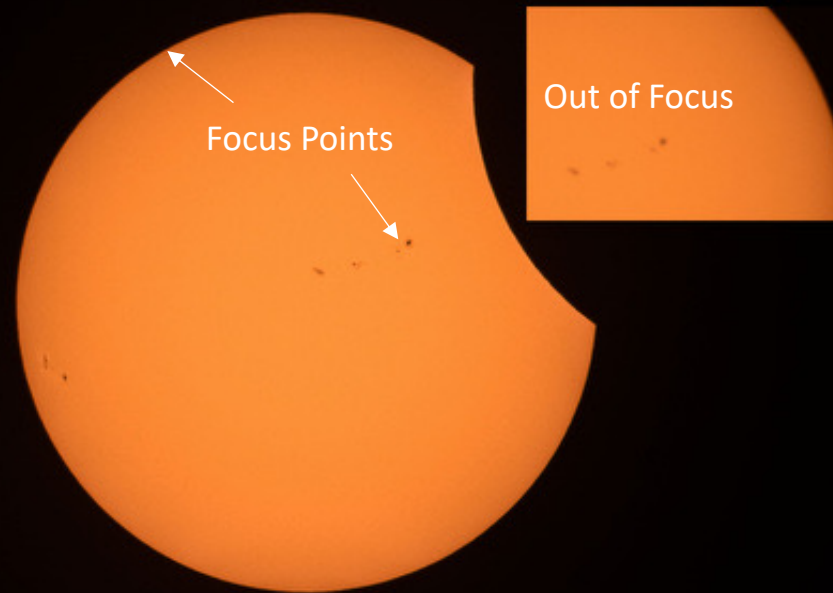
Camera Autofocus Settings

- Have your solar filter in place.
- Focus Point: Single or small group focus.
- Telescope: Autofocus Off. Manual focus only.
- Wide Angled Lens: Autofocus On. Focus on a distant object and then turn off autofocus.
- Zoom lens: Focus on the edge of the sun or a sunspot.

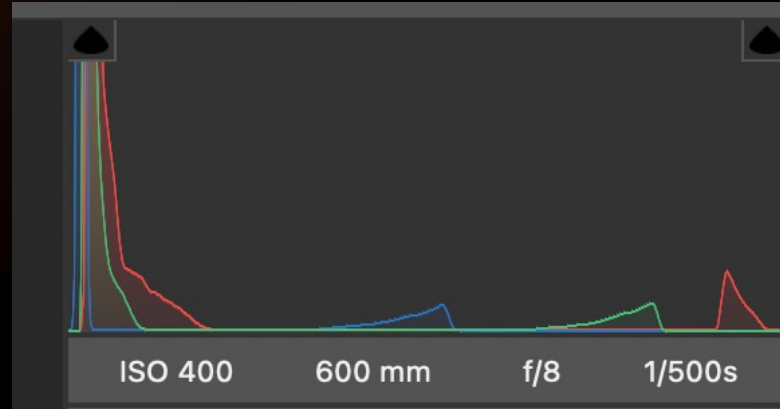


How to Focus: Autofocus Points

Refocus Before Totality



Establishing A Correct Exposure



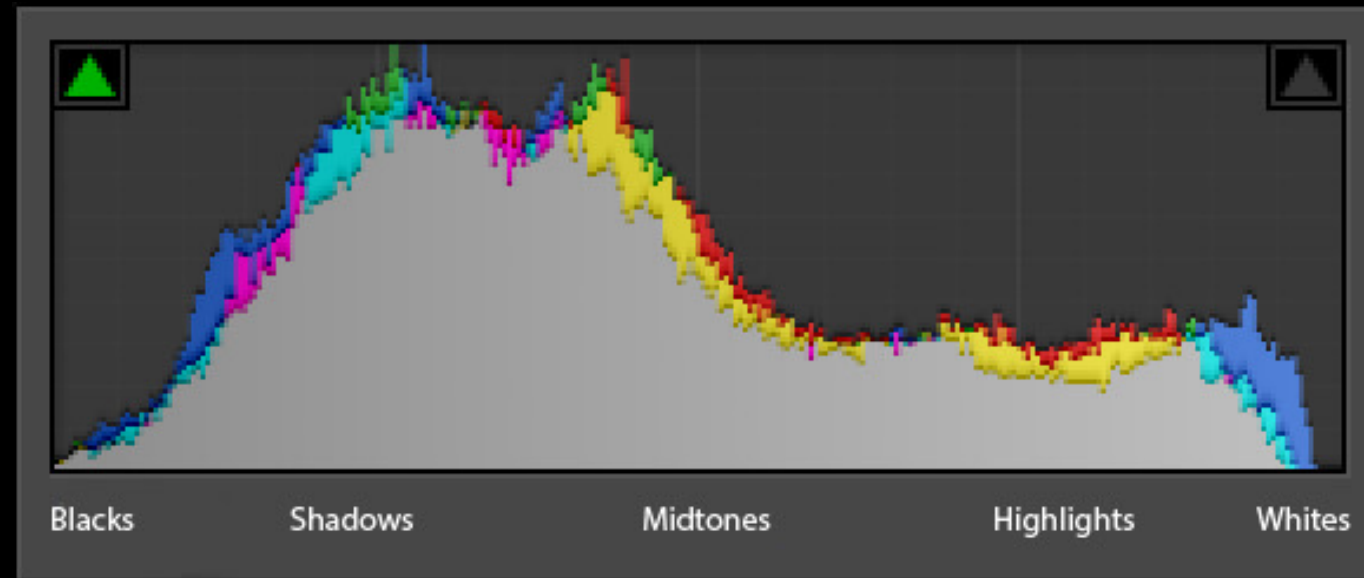
2017 Total Eclipse Images

Full Frame DSLR, 600mm Lens, SolarLite Filter

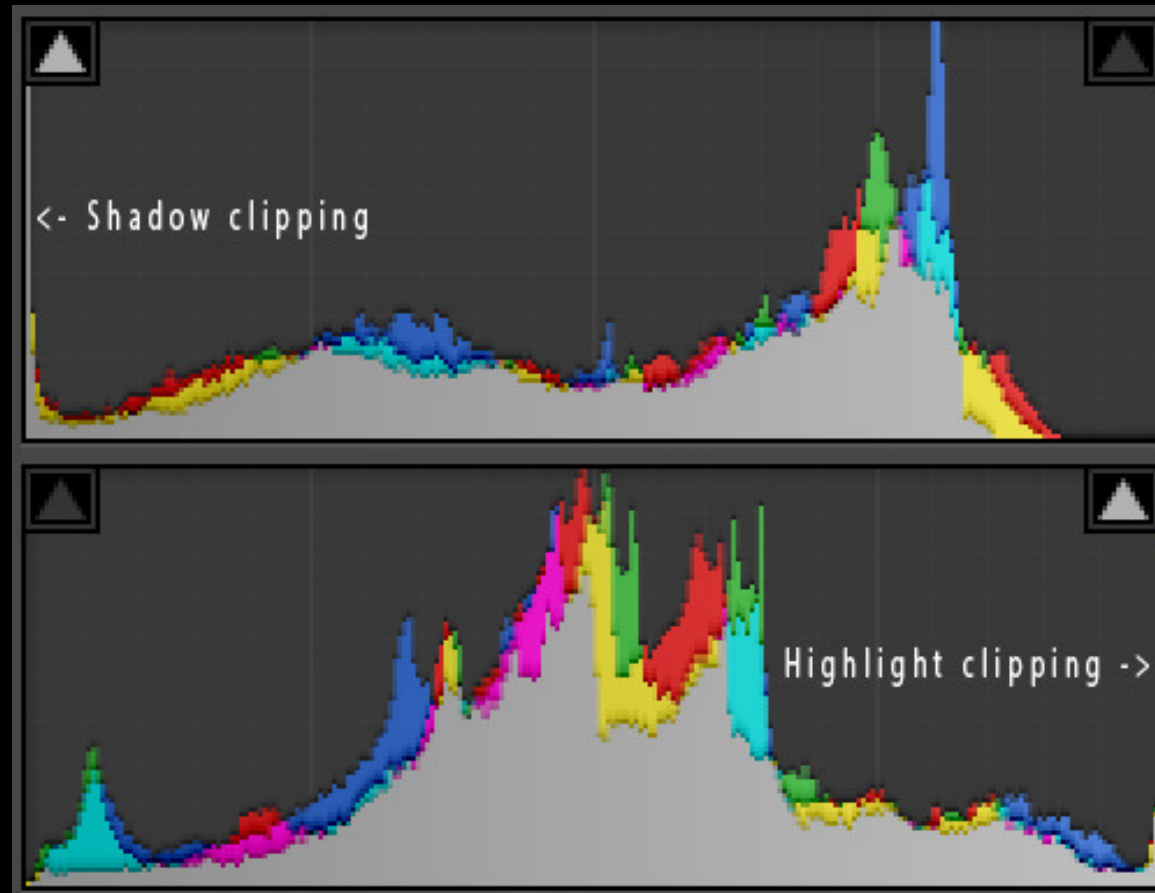
ISO 400, 1/500 sec., f/8

Or ISO 200, 1/1000 sec., f/8

Normal Histogram



Underexposed & Overexposed Histograms



Under and Over Exposure Examples



-2 Stops



-1 Stop



Correct



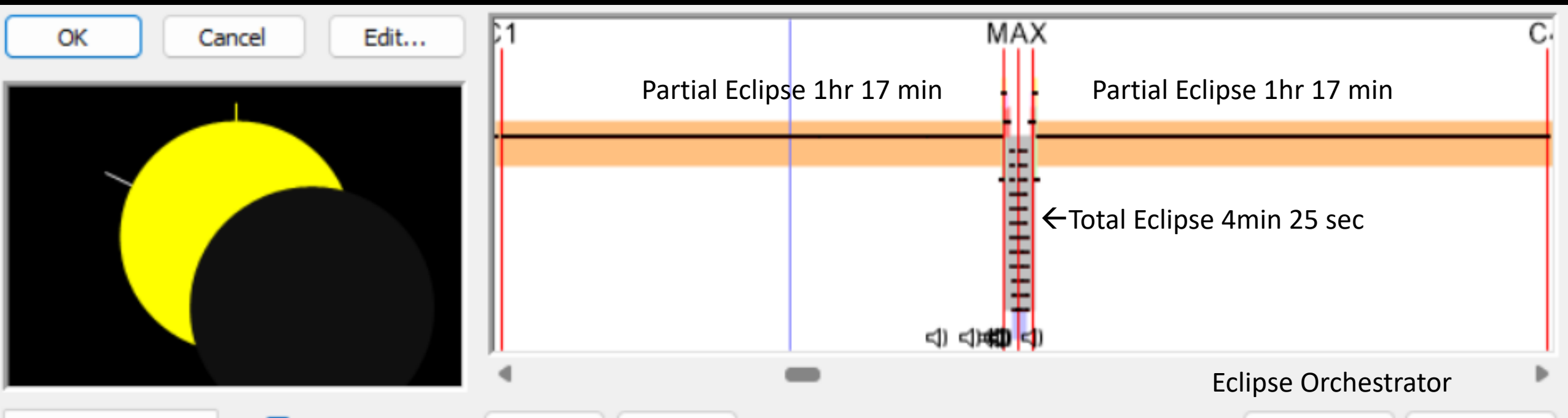
+1 Stop



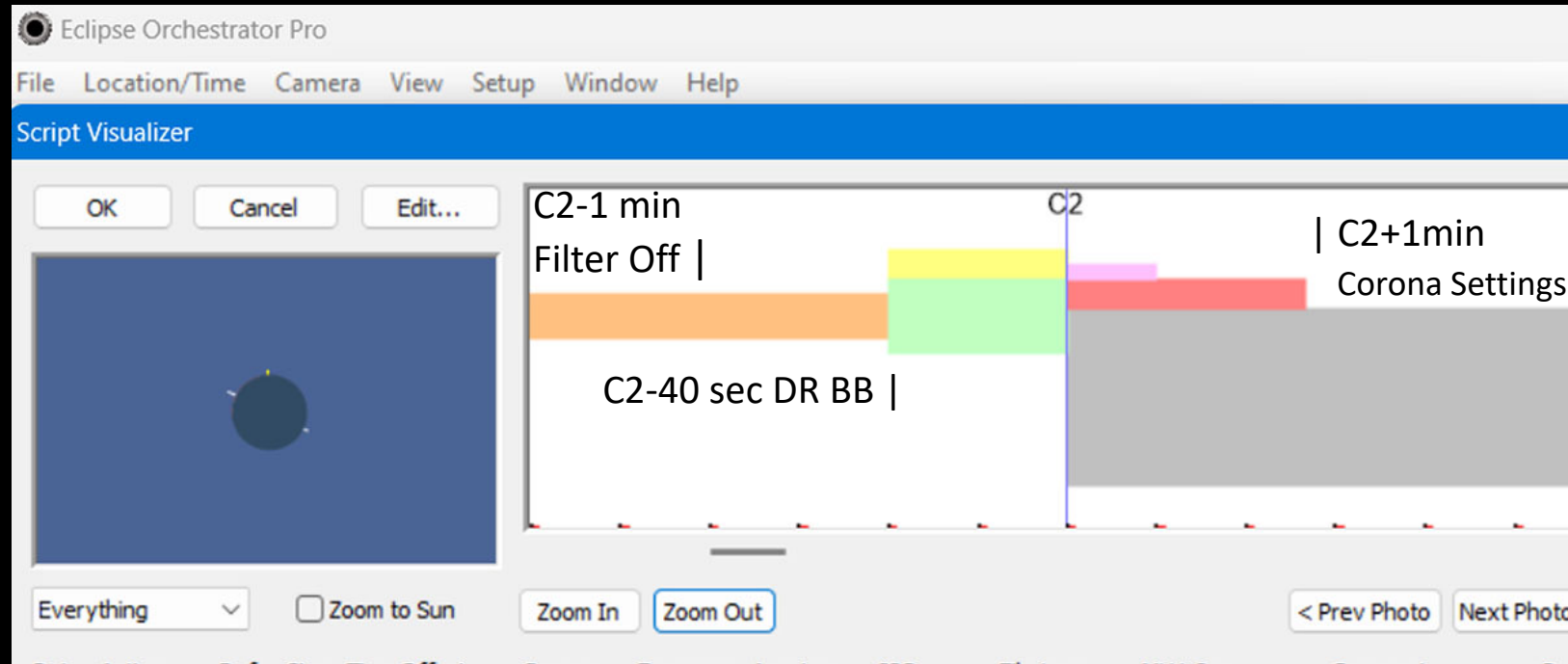
+2 Stops

The correct exposure was ISO 200, 1/1000 sec, f/8
using a 600mm lens with a SolarLite Polymer filter.

Total Solar Eclipse Timing



C2-1 to C2+1 Be Ready



Eclipse Phases

Orange = Partial phases

Green = Diamond Ring

Yellow = Baily's Beads

Pink = Chromosphere

Red = Prominences

Gray = Corona

Violet = Earthshine

Duration

1hr 17min x2

30 seconds

15 seconds

20 seconds

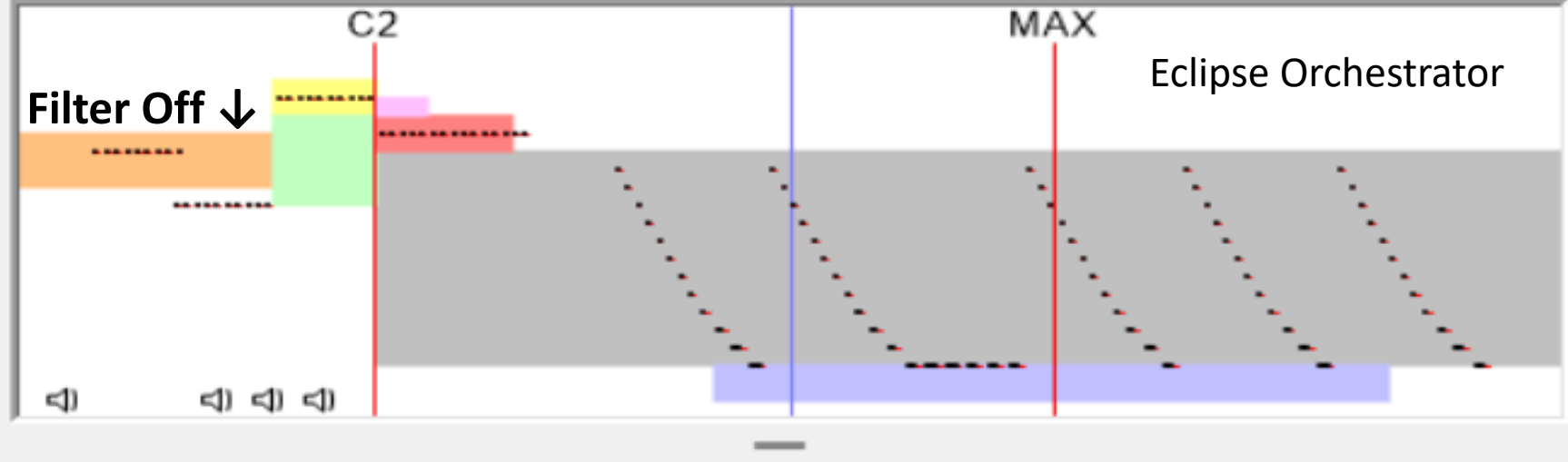
60 seconds

4 min 25 sec

2 min 25 sec

OK Cancel Edit...

April 8, 2024 Total Solar Eclipse Phases, Exposures, and Brackets



Eclipse Phases	Duration	ISO	Shutter Speed	Focal Ratio	Bracket	Interval
Orange = Partial phases	1hr 17min x2	100/400	1/500	f/8	5F1	15 sec
Green = Diamond Ring	30 seconds	100/400	1/2000	f/8	7F1	5 sec
Yellow = Baily's Beads	15 seconds	100/400	1/4000	f/8	7F1	5 sec
Pink = Chromosphere	20 seconds	100/400	1/8000	f/8	7F1	5 sec
Red = Prominences	60 seconds	100/400	1/2000	f/8	7F1	5 sec
Gray = Corona	4 min 25 sec	100/400	1/500, 1/4, 1	f/8	9F1	5 sec
Violet = Earthshine	2 min 25 sec	100/400	1 sec	f/8	9F1	5 sec

*Nikon D850/Z8 ISO 100/400 Partial Phase Bracket: 5F1 = 1/125, 1/250, **1/500**, 1/1000, 1/2000

*Nikon D850, 600mm ISO 100: Max Fast DR, BB, Corona: 5F1 = 1/500, 1/1000, **1/2000**, 1/4000, 1/8000 Q 2.3sec

*Nikon Z8, 500mm ISO 400 BB DR Max Fast: 0F1 = **1/4000**, Q 2.3 sec, Shutter release for 2.2 sec.

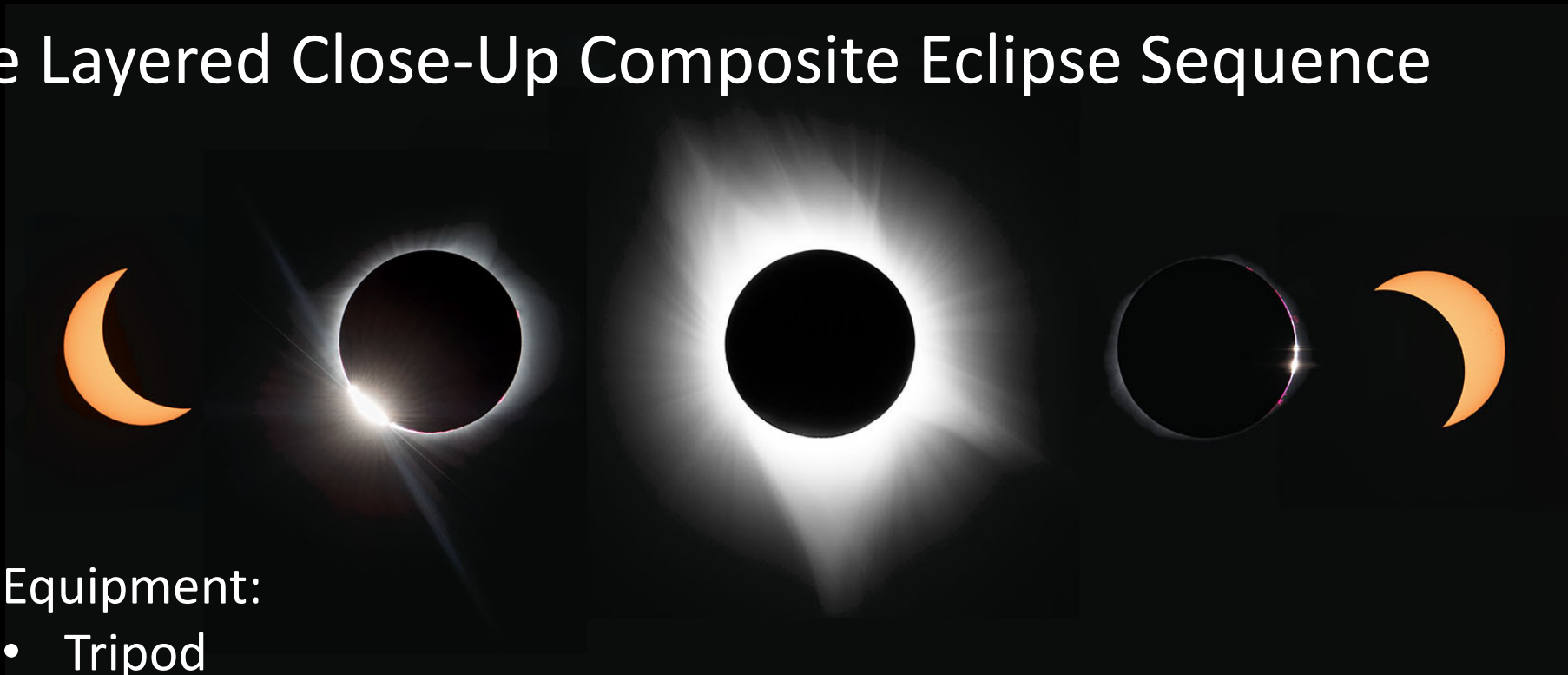
*Nikon Z8, 500mm ISO 400 : Corona/Earthshine Bracket: 9F1 = 1, ½, ¼, 1/8, **1/15**, 1/30, 1/60, 1/125, 1/250

Z8 requires a two stops higher ISO than the D850 for the same exposure. The D850 settings are consistent with mreclipse.com

Layered Composite Annular Eclipse Sequence



Five Layered Close-Up Composite Eclipse Sequence



Equipment:

- Tripod
- Camera of Choice
- Lens for Image Scale
of 1-3 arc-sec/px
- Solar Filter
- Cable Release

Partial Exposure:

- ISO 200
- 1/1000 sec.
- f/8
- Bracket ± 2 stops

Totality Exposure:

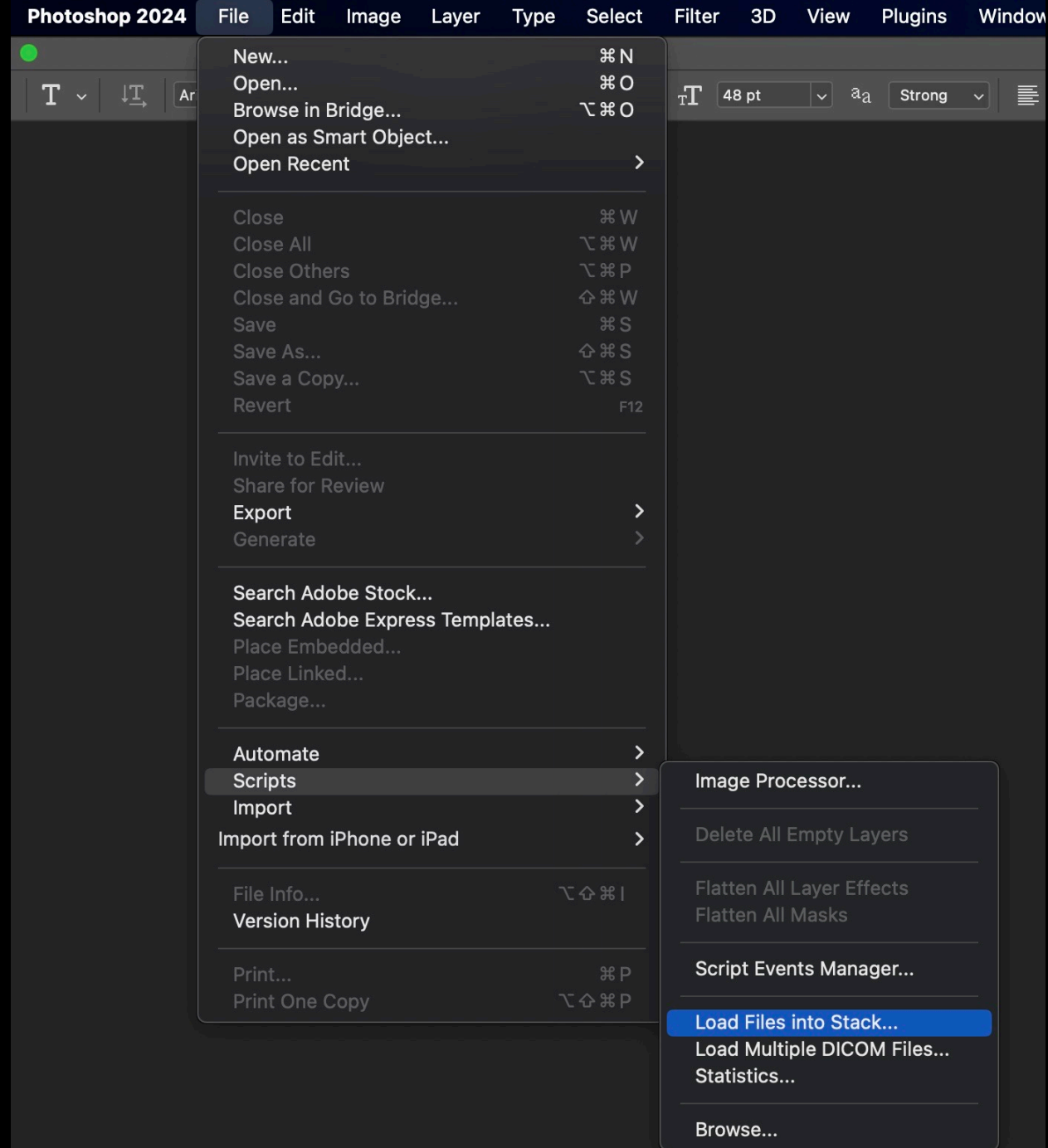
- ISO 200
- 1/8 sec.
- f/8
- Bracket 7F1



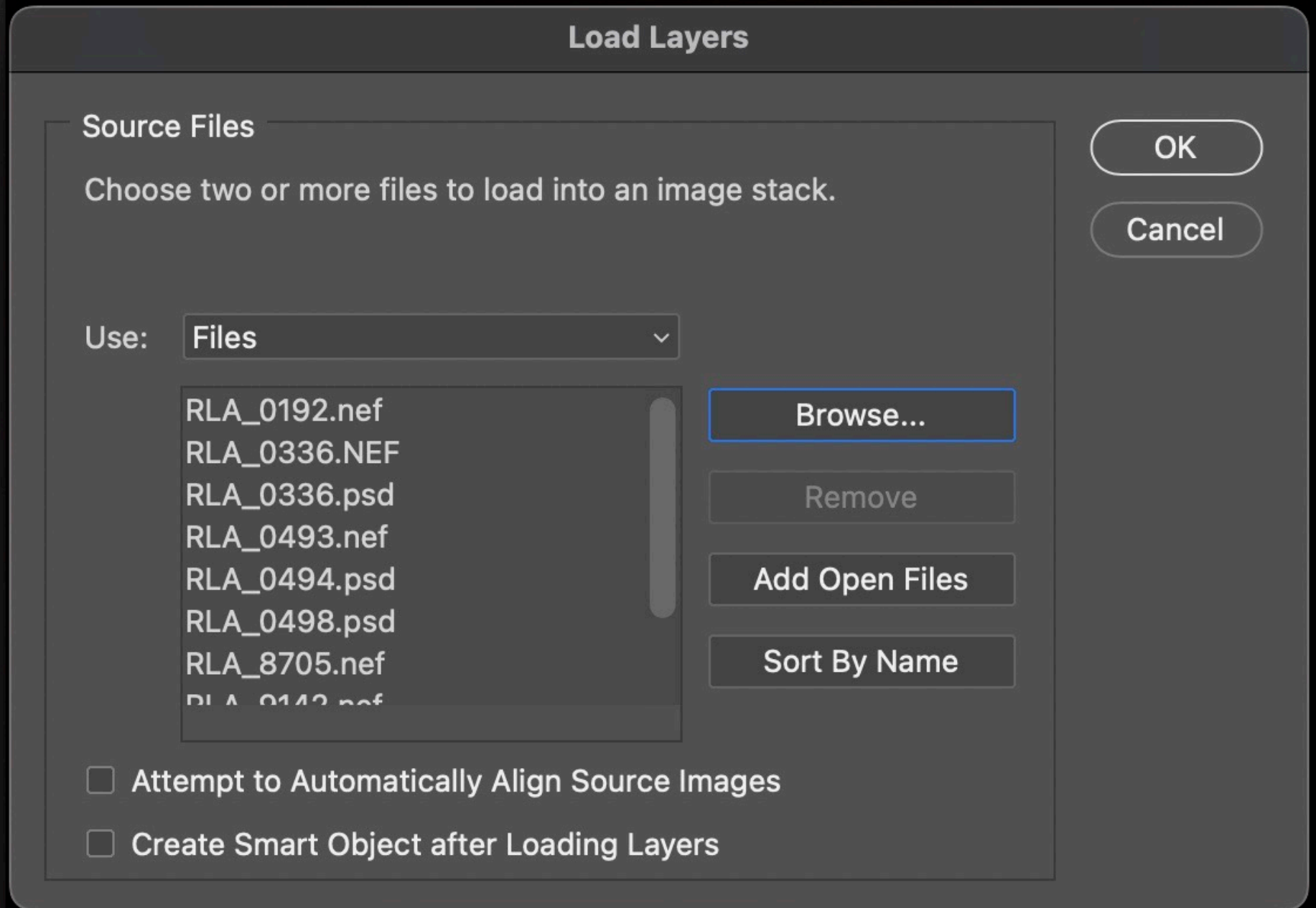
Multilayered Close-up Composite Eclipse Sequence

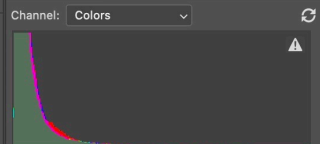


How To Create a Composite Eclipse Sequence in Photoshop



Select Files





Layers

Q Kind

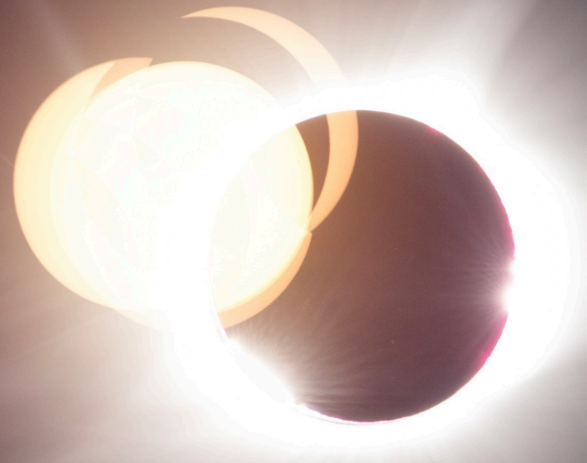
Normal Opacity: 100%

Lock: Fill: 100%

- RLA_0336.psd
 - Smart Filters
 - Camera Raw Filter
- RLA_0493.psd
 - Smart Filters
 - Camera Raw Filter
- RLA_0498.psd
 - Smart Filters
 - Camera Raw Filter
- RLA_0777.nef
- RLA_1002.nef
- RLA_1398.nef
- RLA_1799.nef
- RLA_8705.nef
- RLA_9142.nef
- RLA_9538.nef
- RLA_9907.nef

Files Loaded Into A Stack

Change Blending Mode To "Screen"



History Properties

- Layer Order
- Layer Order
- Layer Order
- Layer Order
- Layer Order
- Layer Order
- Layer Order
- Blending Change

Channel: Colors

Source: Entire Image
Mean: 84.26 Level:
Std Dev: 70.52 Count:
Median: 56 Percentile:
Pixels: 481500 Cache Level: 4



Layers

Q Kind Opacity: 100%

Screen Fill: 100%

- RLA_0336.psd
 - Smart Filters
 - Camera Raw Filter
- RLA_0498.psd
 - Smart Filters
 - Camera Raw Filter
- RLA_0777.nef
- RLA_1002.nef
- RLA_1398.nef
- RLA_1799.nef
- RLA_8705.nef
- RLA_9142.nef
- RLA_9538.nef
- RLA_9907.nef
- RLA_0494.psd

Canvas Size

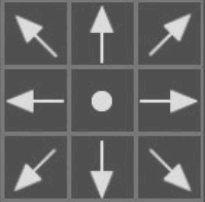
Current Size: 176.2M

Width: 6000 Pixels
Height: 5133 Pixels

New Size: 528.7M

Width: Percent
Height: Percent

Relative

Anchor: 

OK
Cancel

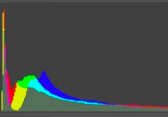
Increase Canvas Size

History Properties >> |

- Blending Change
- Move
- Canvas Size
- Rasterize Layer**
- New Color Fill Layer
- Layer Order
- Blending Change
- Blending Change

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Channel: Colors



Source: Entire Image
Mean: 187.02 Level:
Std Dev: 97.66 Counts:
Median: 255 Percentile:
Pixels: 1444500 Cache Level:

Layers

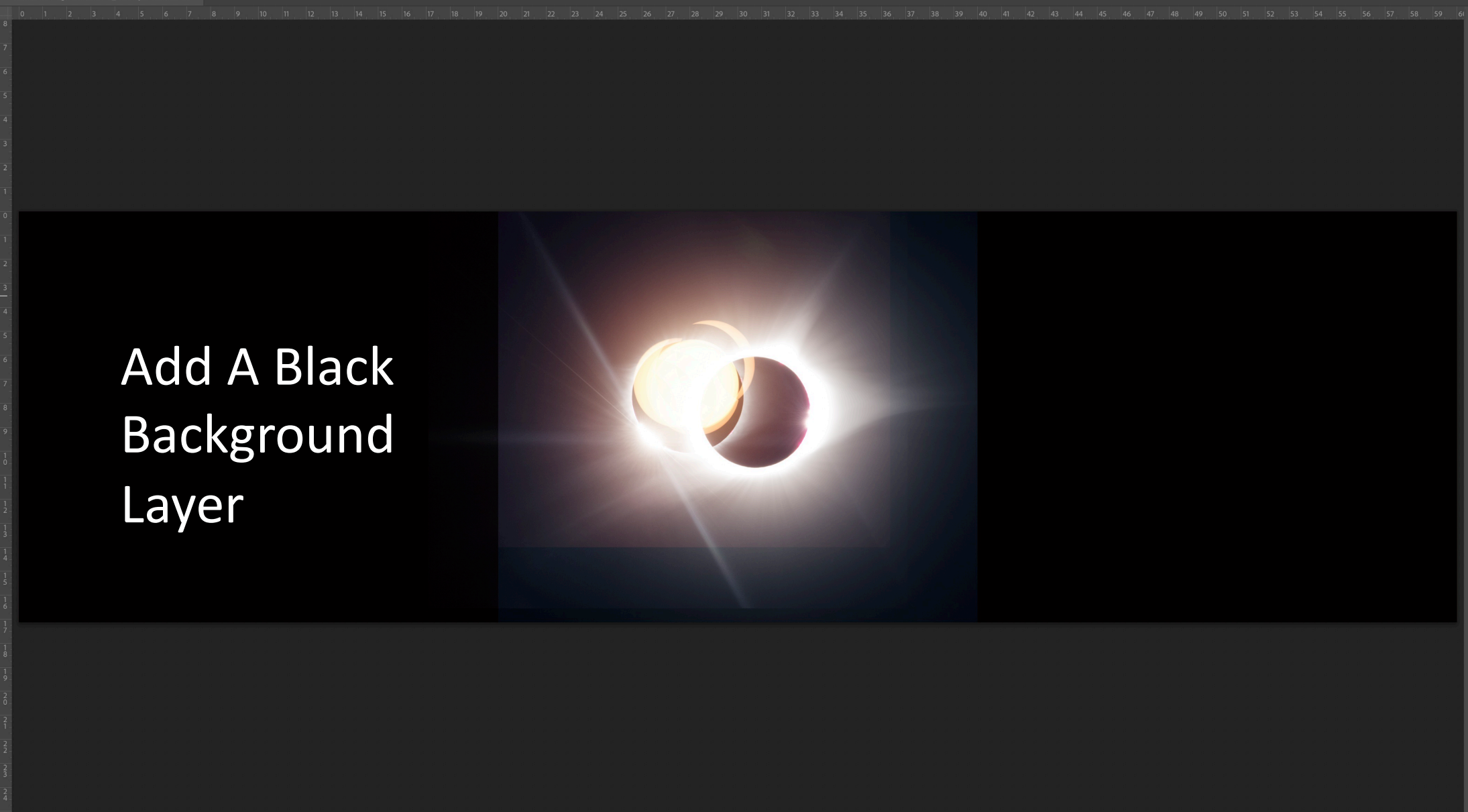
Q Kind ▾ 📄 🔍 T

Screen ▾ Opacity: 100%

Lock: 🔒 🔗 🔒 🔒 🔒 Fill: ▾

- RLA_0336.psd
- RLA_0498.psd
 - Smart Filters
 - Camera Raw Filter
- RLA_0777.nef
- RLA_1002.nef
- RLA_1398.nef
- RLA_1799.nef
- RLA_8705.nef
- RLA_9142.nef
- RLA_9538.nef
- RLA_9907.nef
- RLA_0494.psd





Add A Black
Background
Layer

4 Tomorrow

Channel: Colors

Source: Entire Image
Mean: 29.64 Level:
Std Dev: 58.06 Count:
Median: 2 Percentile:
Pixels: 1444500 Cache Level: 4

Layers

Q Kind Opacity: 100% Fill: 100%

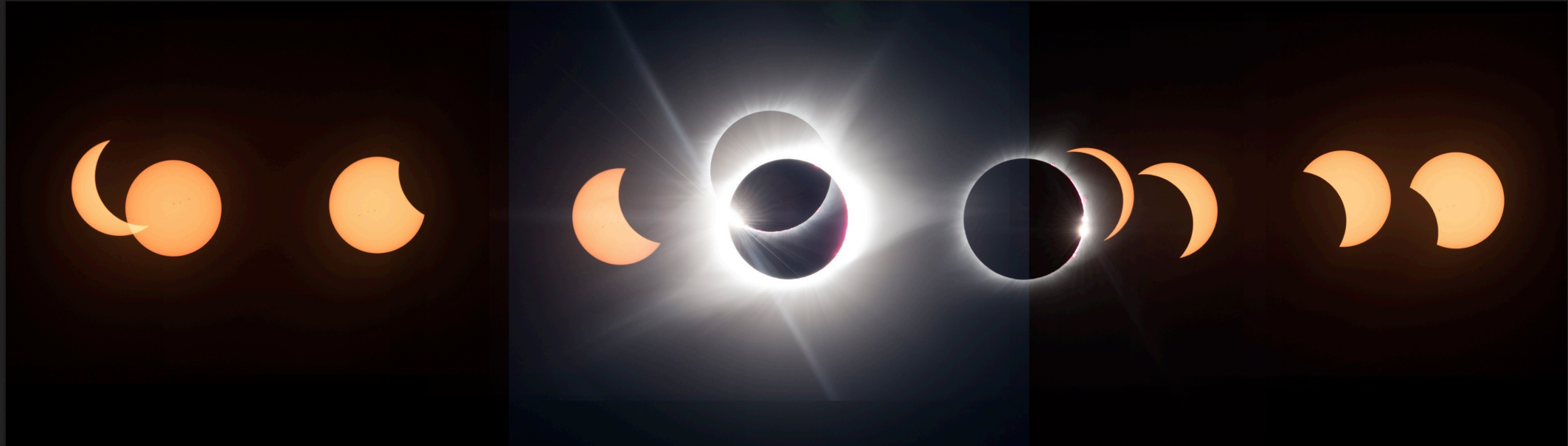
Screen Opacity: 100% Fill: 100%

- RLA_0336.psd
- RLA_0498.psd
 - Smart Filters
 - Camera Raw Filter
- RLA_0777.nef
- RLA_1002.nef
- RLA_1398.nef
- RLA_1799.nef
- RLA_8705.nef
- RLA_9142.nef
- RLA_9538.nef
- RLA_9807.nef
- RLA_0494.psd
- Color Fill 1

22.93% Doc: 528.7M/2.41G

Timeline

Use The Move Tool To Distribute The Images



History

- Move
- Move
- Move
- Layer Order
- Move
- Move
- Move
- Blending Change

Channel: Colors

Source: Entire Image

Mean: 41.56 Level:
Std Dev: 60.89 Count:
Median: 16 Percentile:
Pixels: 1444500 Cache Level: 4

Layers

- RLA_0336.psd
- RLA_0498.psd
 - Smart Filters
 - Camera Raw Filter
- RLA_0777.nef
- RLA_1002.nef
- RLA_1398.nef
- RLA_1799.nef
- RLA_8705.nef
- RLA_9142.nef
- RLA_9538.nef
- RLA_9907.nef
- RLA_0494.psd
- Color Fill 1

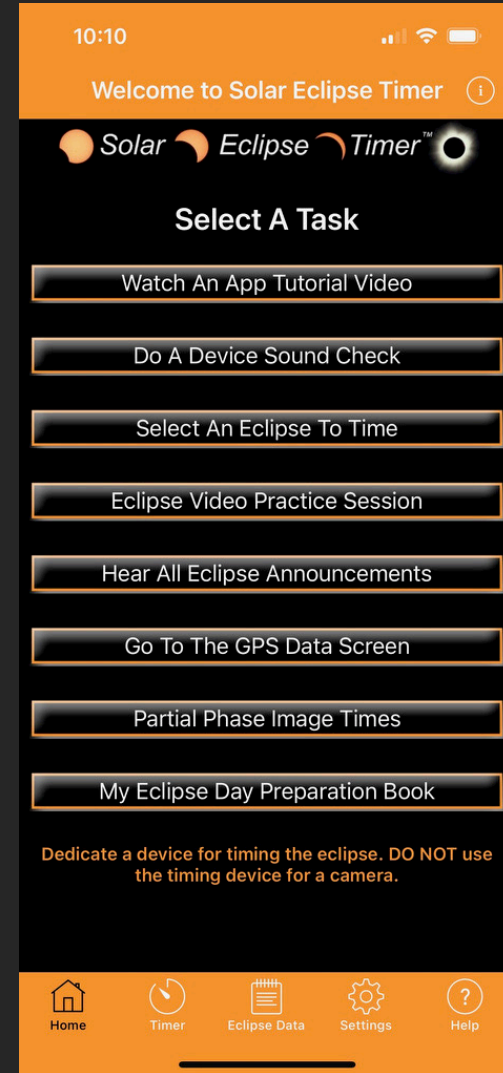
Finish Arranging The Images With The Move Tool



Photopills



Solar Eclipse Timer App



Keep Shooting!



Summary

- Understand the Total Solar Eclipse
- Pick Your Location Near the Line of Totality. Consider Wx
- Understand the Eclipse Timing
- Decide What Type Pictures to Take
- Pick an Image Scale and Field of View
- Pick Your Camera, Lens/Telescope, Solar Filter, Tripod or Telescope Mount, & Intervalometer
- Establish your camera settings.
- Bracket Exposures (insurance).
- Setup Your Gear & Practice at Home on the Sun and Moon
- Keep Shooting
- Have A Backup Plan. Move If Necessary
- Have fun
- Share Your Images
- Learn From Any Unexpected Events or Mistakes

2017 Total Solar Eclipse Animation



References

- Astronomy Tools Calculator: <https://www.astronomy.tools>
- Baily's Beads: <https://www.alpo-astronomy.org/eclipse/observeeclipses/chapter9.htm>
- Eclipsophile: <https://eclipsophile.com/ase2023/>
- Eclipse Maps: http://xjubier.free.fr/en/site_pages/SolarEclipsesGoogleMaps.html
- Eclipse Orchestrator: <http://eclipseorchestrator.com/products/EclipseOrchestrator/index.shtml>
- How to Photograph the Solar Eclipses eBook:
<https://astronomytechnologytoday.com/2023/06/05/how-to-photograph-the-solar-eclipses/>
- NASA: <https://solarsystem.nasa.gov/eclipses>
- National Eclipse: https://nationaleclipse.com/overview_2023.html
- Annular Eclipse Photography
<https://www.brazosvalleyastronomyclub.org/newsletters/summer-2023/how-to-photograph-annular-solar-eclipse.html>
- Photopills: <https://www.photopills.com>
- Photopills Free Eclipse Book: <https://www.photopills.com/articles/solar-eclipse-photography-guide>
- Solar Eclipse Timer: <https://www.solareclipsetimer.com/>
- Space.com: <https://www.space.com/annular-solar-eclipse-2023-guide-ring-of-fire>
- Time and Date: <https://www.timeanddate.com>
- Xjubier Maps: http://xjubier.free.fr/en/site_pages/solar_eclipses/TSE_2024_GoogleMapFull.html