

# The Sun and the Eclipse Across America

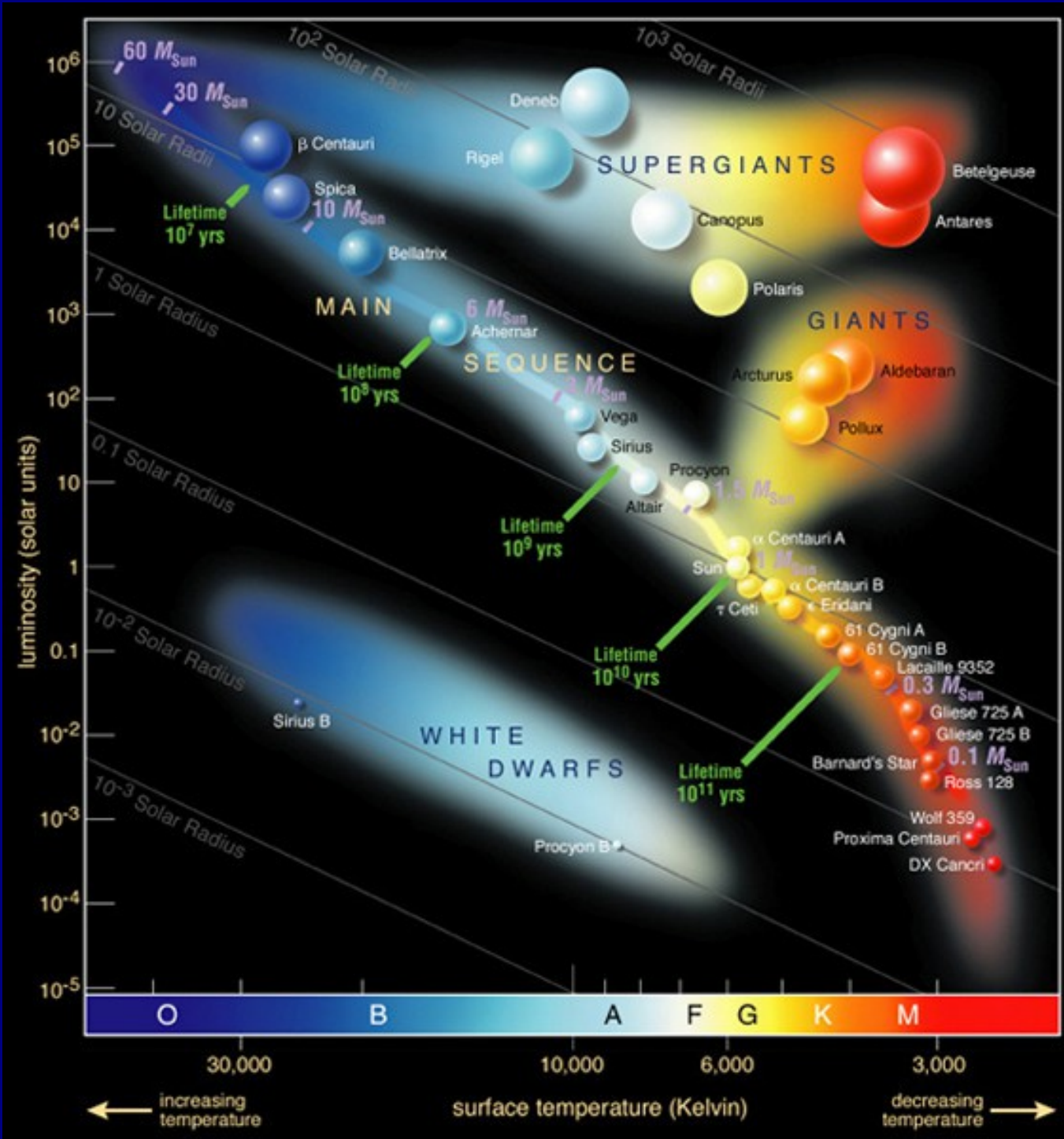
August 21, 2017

Mitzi Adams, Solar Scientist  
ST13, NASA/MSFC



Image Courtesy of Dr. Alphonse Sterling, NASA/MSFC  
August 1, 2008 Gansu Province, China

# What IS the Sun?



The Sun is a Star  
Stars are Mostly Hydrogen Gas

$\alpha$ -Cen-A is G2,  
 $\alpha$ -Cen-B is K1,  
Proxima ( $\alpha$ -Cen-C) is M6,

the Sun is G2  
8.5 light minutes away

Betelgeuse is M2  
643 ly

Bellatrix is B2    Rigel is B8  
250 ly            860 ly



# Layers of the Sun

## The Convection Zone

Energy continues to move toward the surface through convection currents of heated and cooled gas in the convection zone.

## The Corona

The ionized elements within the corona glow in the x-ray and extreme ultraviolet wavelengths. NASA instruments can image the Sun's corona at these higher energies since the photosphere is quite dim in these wavelengths.

## The Radiative Zone

Energy moves slowly outward—taking more than 170,000 years to radiate through the layer of the Sun known as the radiative zone.

## Sun's Core

Energy is generated by thermonuclear reactions creating extreme temperatures deep within the Sun's core.

## Coronal Streamers

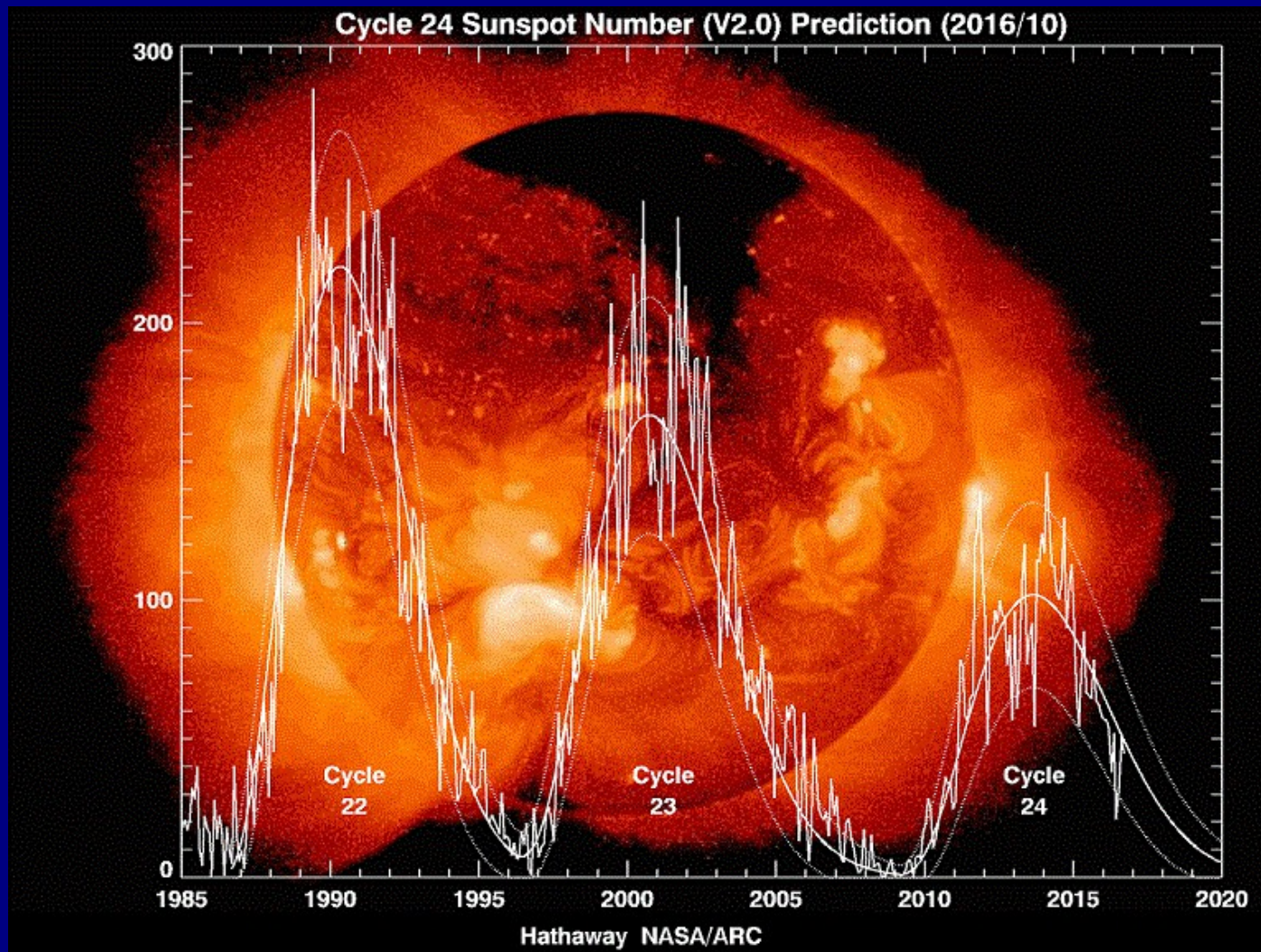
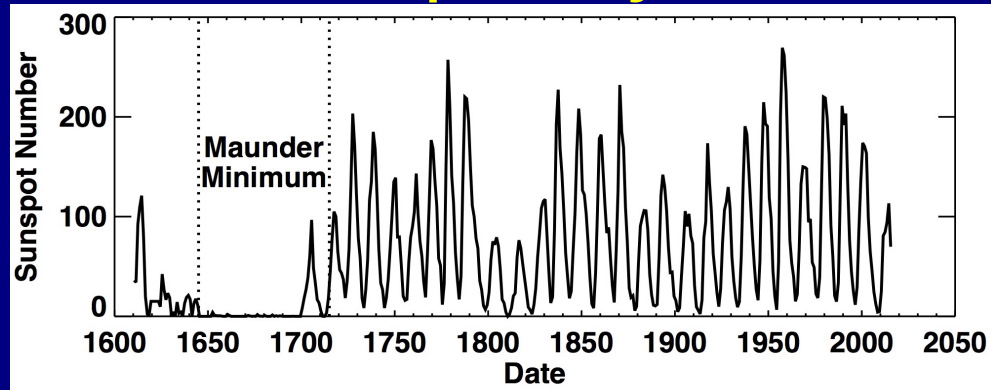
The outward-flowing plasma of the corona is shaped by magnetic field lines into tapered forms called coronal streamers, which extend millions of miles into space.

## The Chromosphere

The relatively thin layer of the Sun called the chromosphere is sculpted by magnetic field lines that restrain the electrically charged solar plasma. Occasionally larger plasma features—called prominences—form and extend far into the very tenuous and hot corona, sometimes ejecting material away from the Sun.

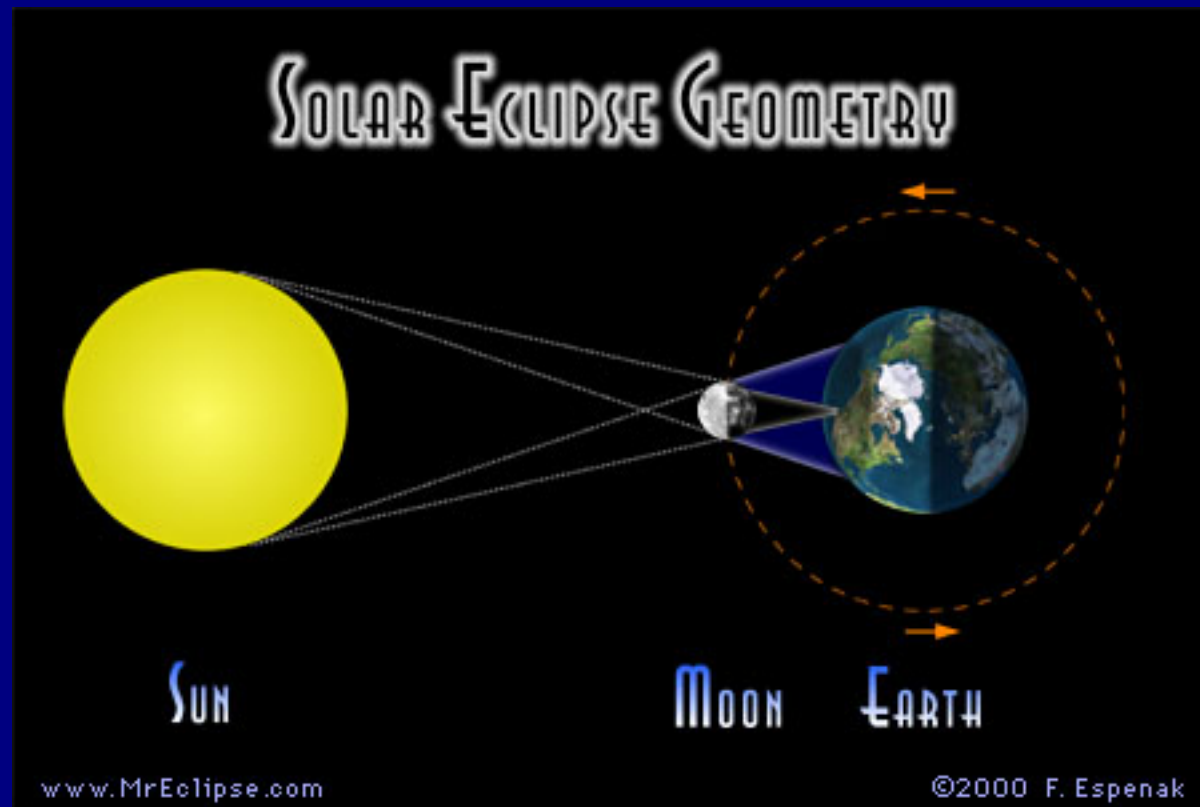


# Sunspot Cycle



# What is an Eclipse?

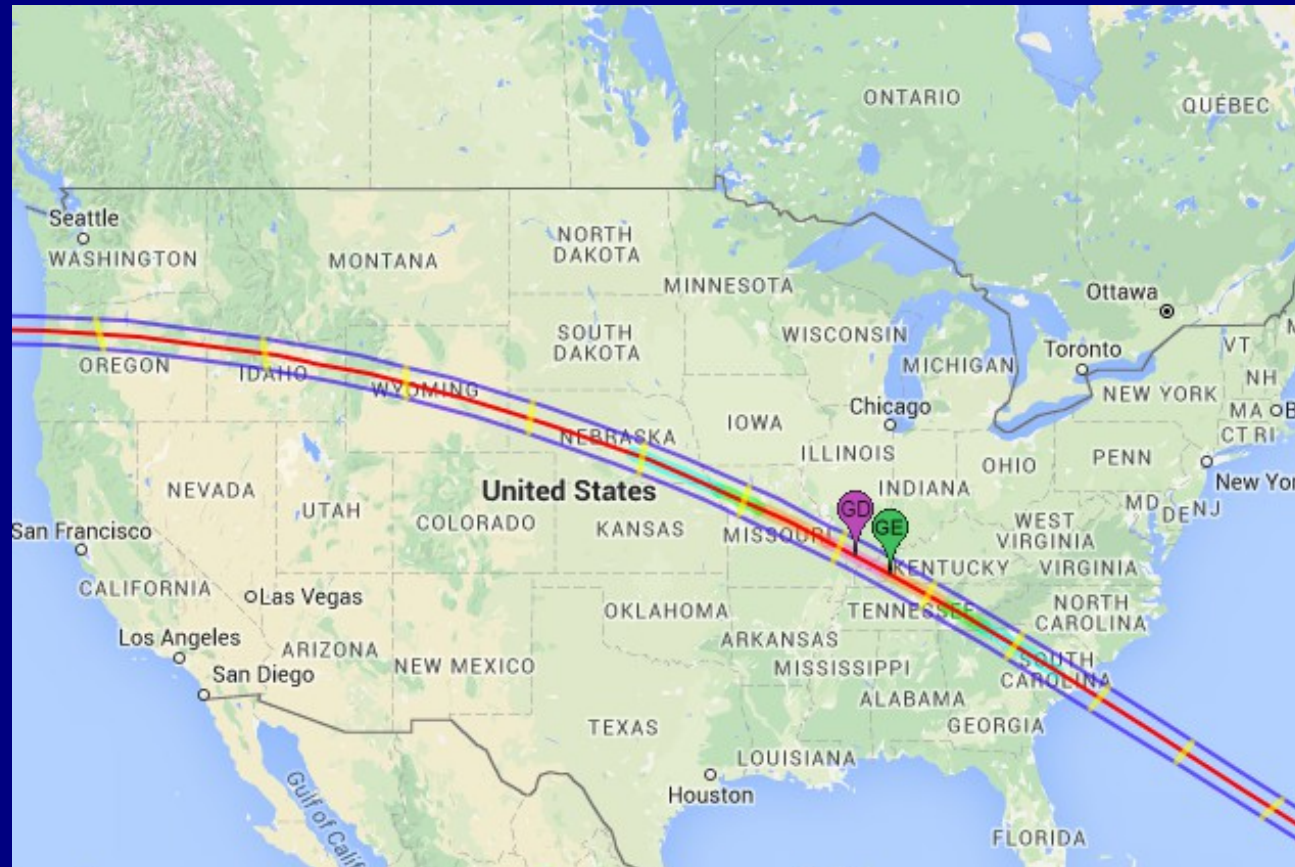
An eclipse happens when one object blocks the light of another



Images Used With Permission

# Eclipse Across America

August 21, 2017



Close to Hopkinsville, Kentucky (GE):

Start of partial eclipse	16:56 UT	11:56 a.m. CDT
Start of totality	18:24 UT	1:24 p.m. CDT
Maximum eclipse	18:25 UT	1:25 p.m. CDT
End of totality	18:26 UT	1:26 p.m. CDT
End of partial eclipse	19:51 UT	2:51 p.m. CDT

# Eclipse Across America...in Tennessee

August 21, 2017



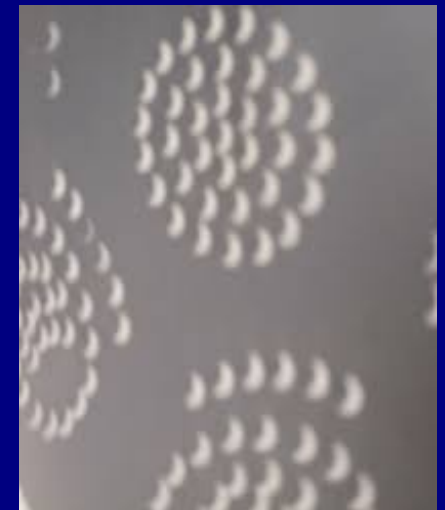
# What You Can See: Partial Eclipse

The entire United States will see a partial eclipse.





# Use a Kitchen Colander or Trees For Partial Phases



# Shadow Bands

Light shines through air, creating a wavy pattern similar to light through water in a pool



# Total Eclipse: Diamond Ring and Bailey's Beads



# What You Can See: Total Eclipse



Zophia Edwards wide-angle view, from Jay Pasachoff's Eclipse 2013 page

Image Used With Permission

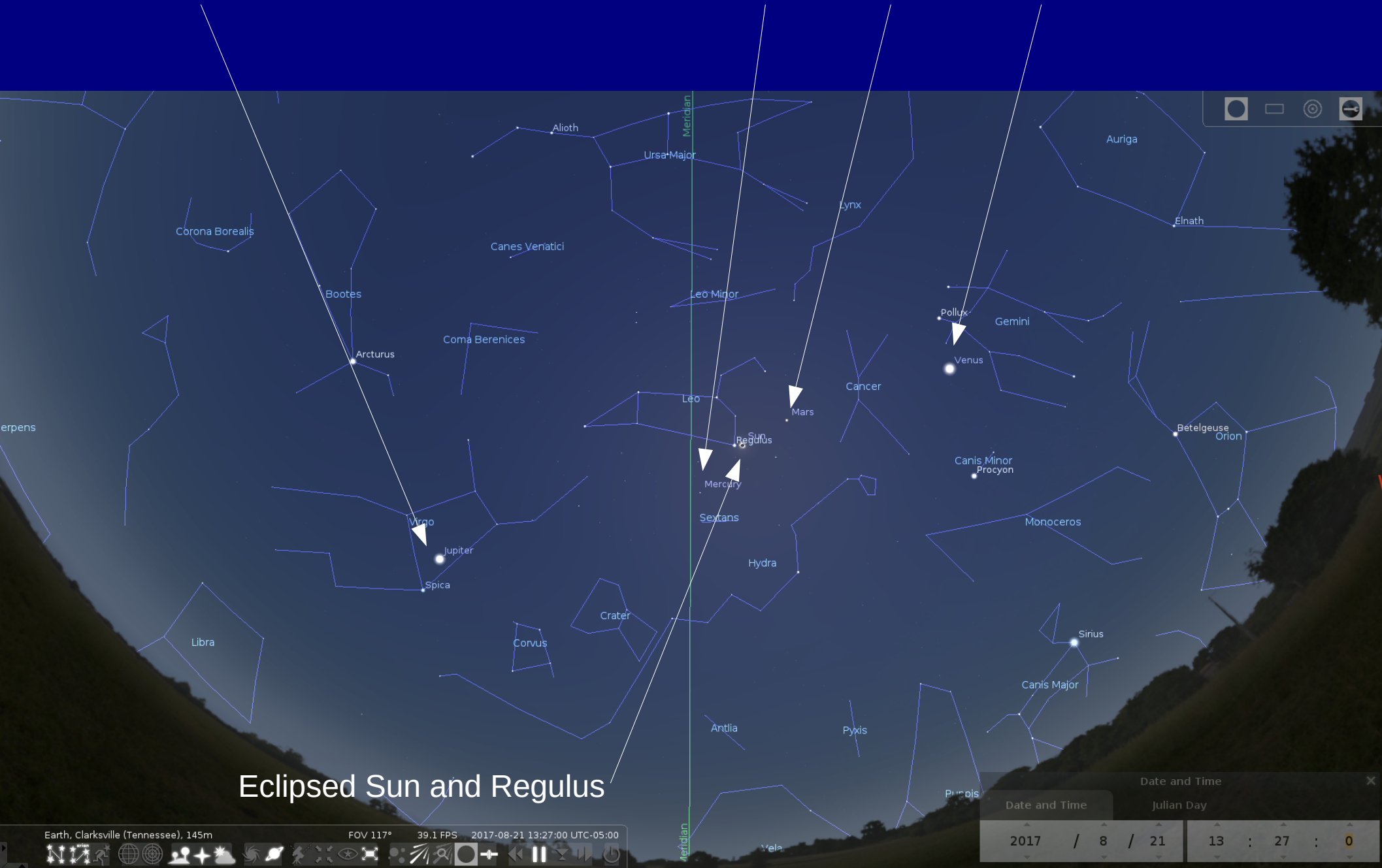
# The Corona and Prominences



Rob Lucas, with Jay Pasachoff's 2013 Eclipse Expedition  
Image Used With Permission

# The Sky During Totality

Jupiter is to the east of the Meridian (left), Mercury, Mars, and Venus to the west.



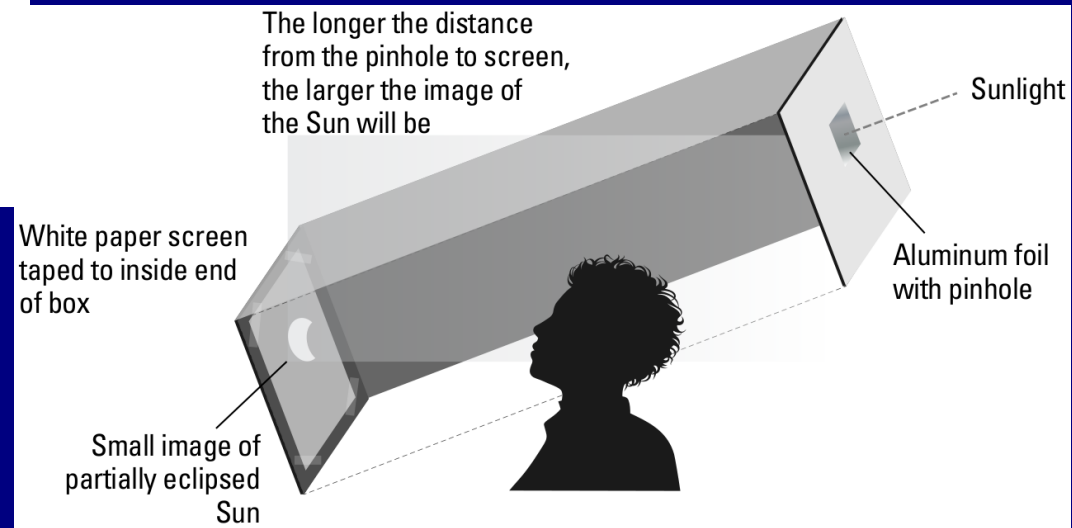
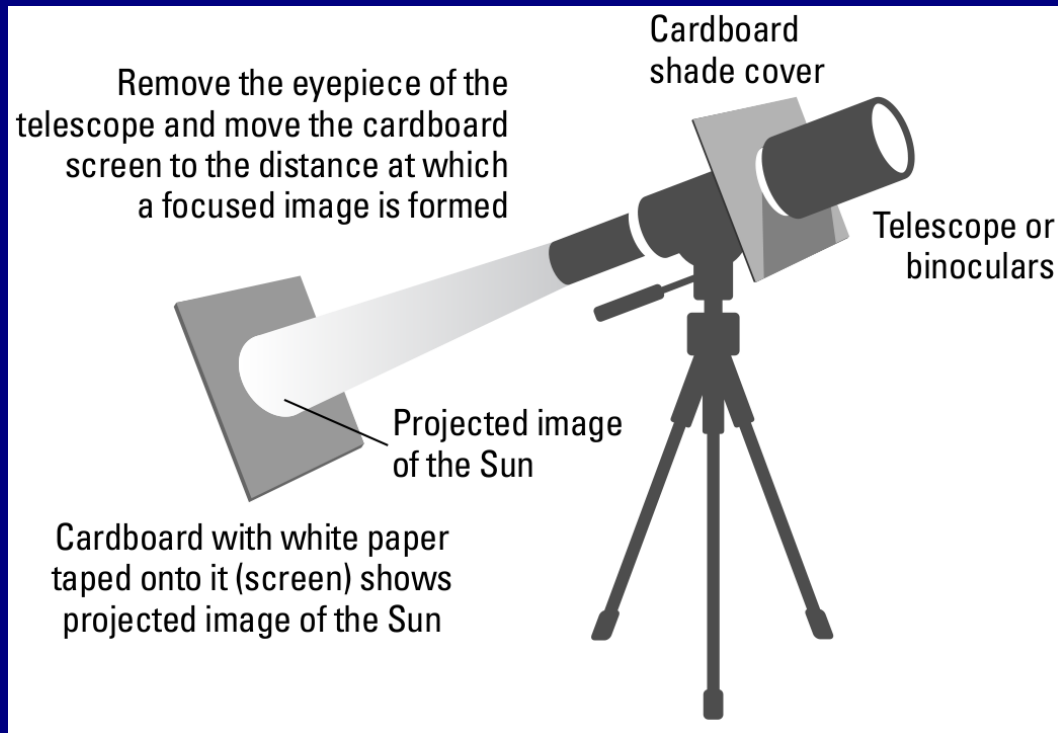
# Safely Viewing an Eclipse

# How to Safely Observe An Eclipse

No Special Rules for Lunar Eclipses

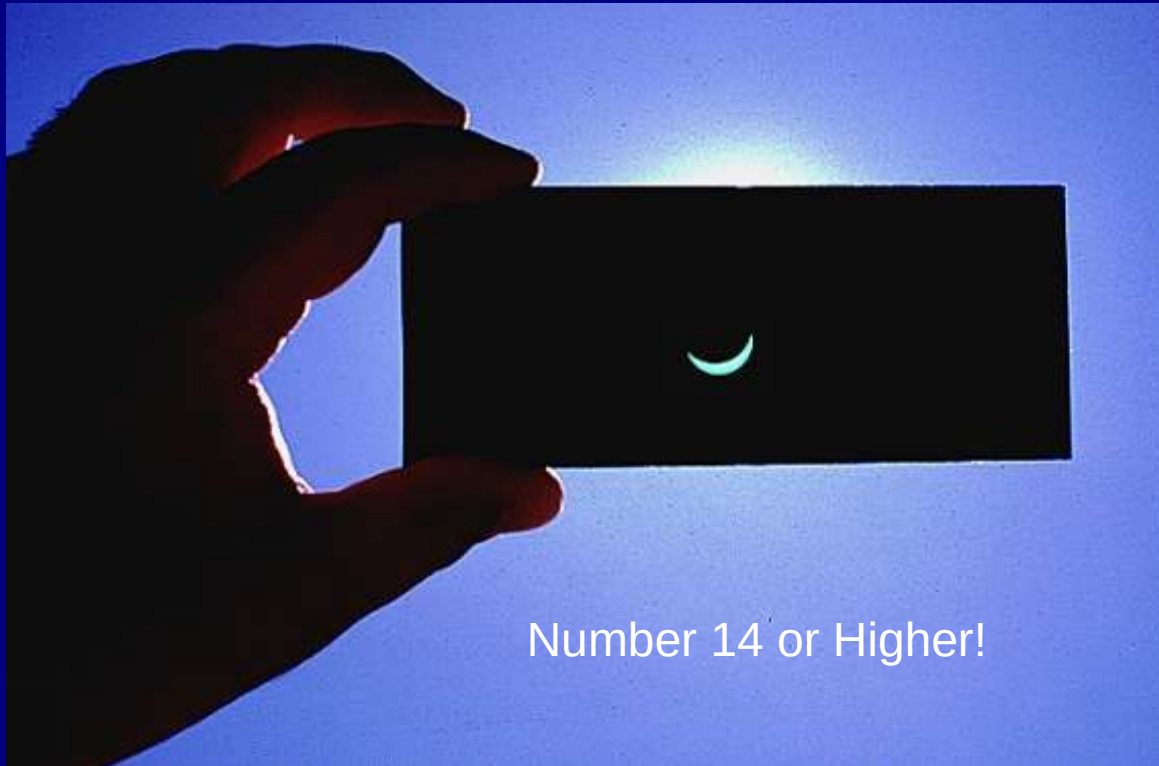
For Solar Eclipses:

Projection  
Special Telescope Filters  
Eclipse Glasses  
Number 14 Welder's Glass





# Eclipse Glasses and Welder's Glass



Number 14 or Higher!

# Solar Filters for Telescopes



# More Information

[http://www.astrosociety.org/tov/Build\\_a\\_Sun\\_Funnel2.pdf](http://www.astrosociety.org/tov/Build_a_Sun_Funnel2.pdf)



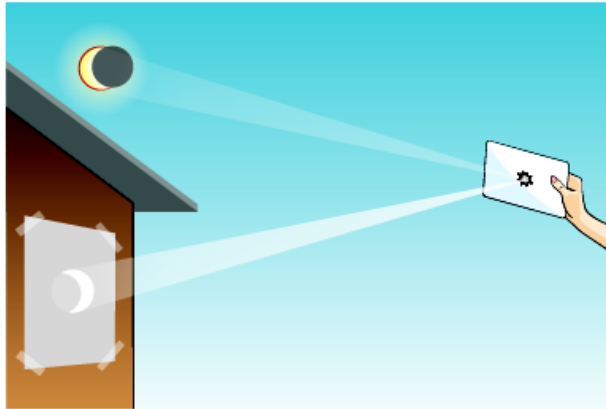
<http://www.nasa.gov/offices/education/about/index.html>

<http://www.greatamericaneclipse.com/>

<http://eclipse.gsfc.nasa.gov/SEgoogle/SEgoogle2001/SE2017Aug21Tgoogle.html>

# Safely Observing the Sun

**WARNING: Never look directly at the Sun without proper eye protection. You can seriously injure your eyes.**



**Mirror in an Envelope**  
Slide a mirror into an envelope with a ragged hole cut into the front. Point the mirror toward the Sun so that an image is reflected onto a screen at least 5 meters (about 15 feet) away. The longer the distance, the larger the image.

**Do not look at the mirror, only at the screen.**

Photograph (below) Copyright © Elisa J. Israel



## Strange Shadows!

Sunlight through trees produces projected crescents during partial phases.

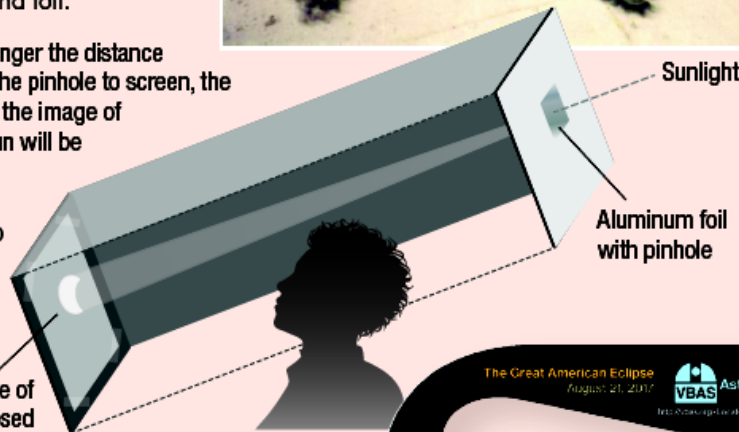
## Go Stick Your Head in a Box

You can make this simple "eclipse telescope" with some cardboard, paper, tape, and foil.

The longer the distance from the pinhole to screen, the larger the image of the Sun will be

White paper screen taped to inside end of box

Small image of partially eclipsed Sun



## Sun Funnel

Make this device for your telescope with simple instructions at: [www.astrocity.org/tov/Build\\_a\\_Sun\\_Funnel.pdf](http://www.astrocity.org/tov/Build_a_Sun_Funnel.pdf)

## Cool in the Shades

Visit the Von Braun Astronomical Society (or your local astronomical society) and pick up a pair of these special Eclipse Sunglasses!

[www.vbas.org](http://www.vbas.org)



All images used with permission.

## Local Area Eclipse Details

Location	% Covered	Start (CDT)	Max (CDT)	End (CDT)
Nashville, TN	100.0%	11:58AM	1:28PM	2:54PM
Totality begins 1:27PM • Totality ends 1:29PM				
Brentwood, TN	100.0%	11:58AM	1:28PM	2:54PM
Totality begins 1:28PM • Totality ends 1:29PM				
Franklin, TN	99.9	11:58AM	1:28PM	2:54PM
Fayetteville, TN	98.2	11:59	1:30	2:56
Ardmore, AL/TN	97.3	11:59	1:29	2:55
Florence, AL	95.9	11:57	1:28	2:54
Athens, AL	96.7	11:59	1:29	2:56
Decatur, AL	96.1	11:59	1:30	2:56
Hartselle, AL	95.8	11:59	1:30	2:56
Madison, AL	96.7	11:59	1:30	2:56
USSRC	96.8	11:59	1:30	2:56
Huntsville, AL	97.0	11:59	1:30	2:56
VBAS	97.1	12:00NOON	1:30	2:56
Arab, AL	96.0	12:00	1:31	2:57
Gurley, AL	97.1	12:00	1:31	2:57
Guntersville, AL	96.4	12:01	1:31	2:57
Scottsboro, AL	97.4	12:01	1:31	2:57
Bridgeport, AL	98.6	12:01	1:32	2:57

JAVA Script Solar Eclipse Explorer  
<http://eclipse.gsfc.nasa.gov/JSEX/JSEX-NA.html>

# Safely observing an **eclipse**

National Aeronautics and Space Administration



Never look at the Sun directly without proper eye protection, except during totality of a solar eclipse.

During the partial phases of a solar eclipse you must use special solar filters, eclipse glasses, #14 welder's glass, or handheld solar viewers. Never use homemade or un-tested materials for direct solar viewing.

Check eclipse glasses for ISO number 12312-2 or European Union certification (CE), which certifies that the product meets international standards.



## Partial Eclipse Glasses on

The eclipse begins when the sun's disk is partially blocked by the moon. This partial eclipse phase can last over an hour.



## Diamond Ring Glasses on

The last of the sunlight streaming through the Moon's valleys creates a single bright flash of light on the side of the Moon. This is known as the diamond-ring effect, and it marks the last few seconds before totality begins.



## Baily's Beads Glasses on

As totality approaches, only the low-lying valleys on the Moon's edge allow sunlight through, forming bright spots of light called Baily's Beads.



## Totality Glasses off

Once the diamond ring disappears and the moon completely covers the entire disk of the sun, you may safely look at the eclipse without a solar filter. Be careful to protect your eyes again before the end of totality—the total eclipse may last less than a minute in some locations.



## Final Stages Glasses on

A crescent will begin to grow on the opposite side of the sun from where the Baily's Beads shone at the beginning. This crescent is the sun beginning to peek out from behind the Moon and its your signal to stop looking directly at the eclipse. Make sure you have safety glasses back on!



## Safely observing the Sun!

Warning! Never look directly at the sun without proper eye protection. You can seriously injure your eyes. Check with local science museums, schools and astronomy clubs for eclipse glasses—or purchase an ISO 12312-2 compliant and CE certified pair of these special shades!



[www.nasa.gov](http://www.nasa.gov)