



National Aeronautics and Space Administration

NASA Helio Club

Session 2 Observing the Sun

NASA Heliophysics Education Activation Team



Materials Needed for this Session

Basics

- Writing tools (pens or pencils)
- Art supplies (markers or crayons)
- (1) pair of scissors
- (1) roll of tape

Prior Knowledge/Evaluate

- [Handout_KWL_Session_2](#)

Engage

- digital resources only

Explore: Activity 1

- [Handout_Build_a_Pinhole_Projector](#)
- [Handout_Solar_Observation_Data_Sheet](#)
- [Handout_2023_&_2024_Solar_Eclipse_US_Map](#)
- (1) Solar Eclipse Glasses
- (2) pieces of 8.5"x11" white cardstock
- (1) 5"x 5" piece of aluminum foil
- (1) paperclip
- tape
- scissors

Explain: Activity 2

- [Handout_Sample_Data_for_Investigating_the_Sun](#)
- [Handout_The_EM_Spectrum](#)
- [Handout_UV_Bead_Data_Sheet](#)
- [Handout_UV_Bead_Bookmark](#)
- (10-15) UV-reactive beads
- (1) invisible ink pen (UV reactive ink)
- (1) UV light (often included with invisible ink pens)
- string

Extend: Activity 3

- [Handout_Coronagraph_Flip_Book](#)
- (1) medium binder clip
- scissors



Use a notebook or the extra paper in the Helio Club Youth Guide to record observations, collect data, and organize ideas.

Session 2: Notes



What do you already know about the Sun ?

Session 2: KWL		
K - what do we already know?	W- what do we wonder about?	L- what did we learn?
<p>What do we already know about observing the Sun?</p> <p>Which methods do you know are safe for observing the Sun?</p>	<p>Record questions you have about observing the Sun in this column.</p>	<p>Record what you learned about observing the Sun in this column.</p>



The Sun Now!

Home Mission ▾ Data ▾ News & Resources ▾ Outreach ▾ Gallery ▾ RSS ▾

SDO | Data

- The Sun Now
- AIA/HMI Browse Data
- EVE L2 Browse Data
- Daily Movies
- Browse Data Dashboard
- Synoptic Maps
- HMI & AIA Channels
- Best Practice

AIA 193 Å

AIA 304 Å

Data Links ▾

Data Links ▾

Click on each image to increase in size.

Check out the “Daily Movies” to see movies of the Sun.

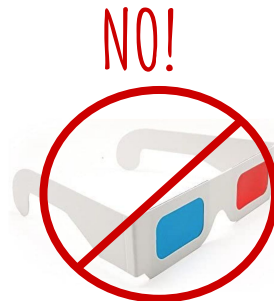


Safe Solar Viewing Methods:

Solar Eclipse Glasses

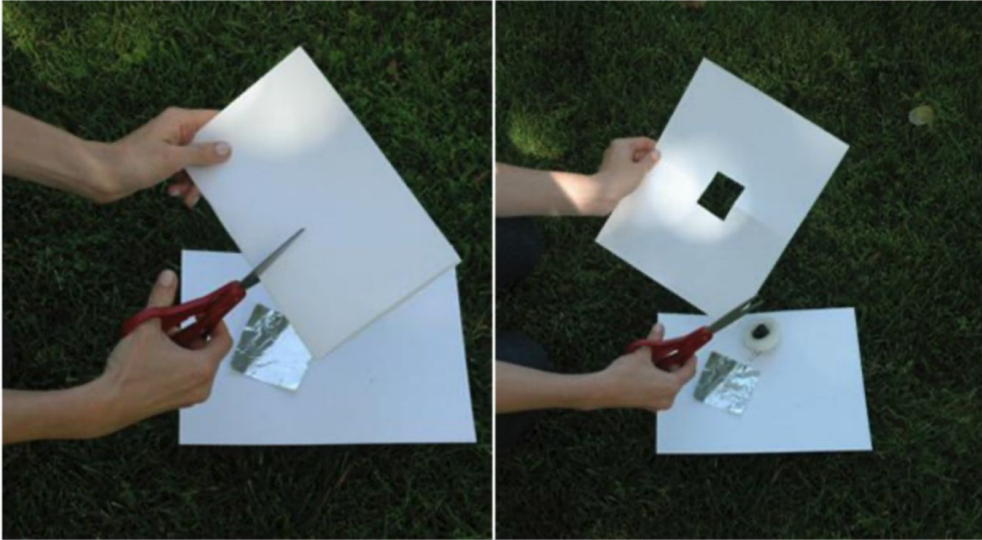
- Sunglasses are not appropriate for looking at the Sun.
- **Solar eclipse glasses** are typically 100,000 times darker than sunglasses and are made of black polymer, a flexible resin infused with carbon particles. This **blocks out all UV rays and nearly all visible light**.
- 3D or “stereo glasses” cyan /red lenses only filter color (visible light).

Never look at the Sun without proper safety equipment.



Safe Solar Viewing Methods:

Pinhole Projector



1. Cut a square hole

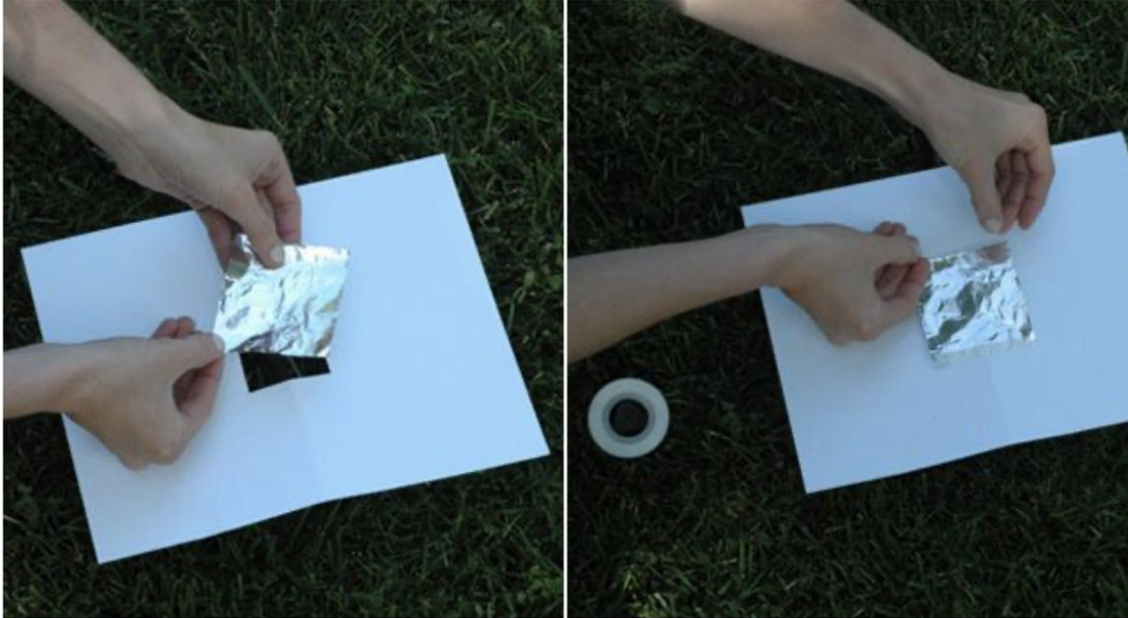
Cut a square hole into the middle of one of your pieces of card stock.

Never look at the Sun without proper safety equipment.

Credit: NASA / JPL



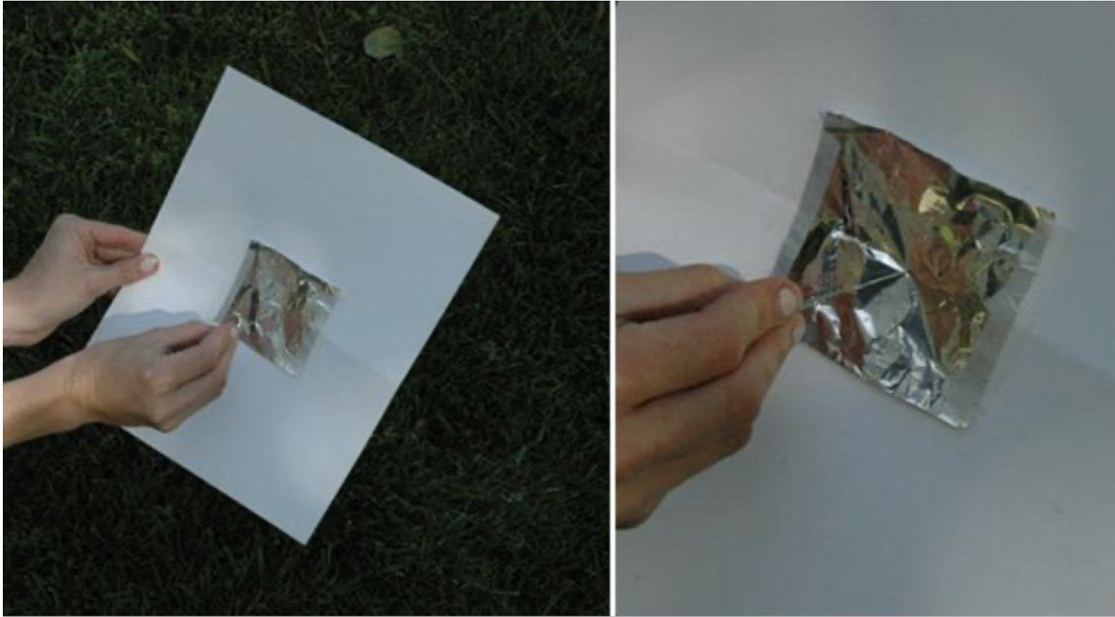
Pinhole Projector



2. Tape foil over the hole

Tape a piece of aluminum foil over the hole.

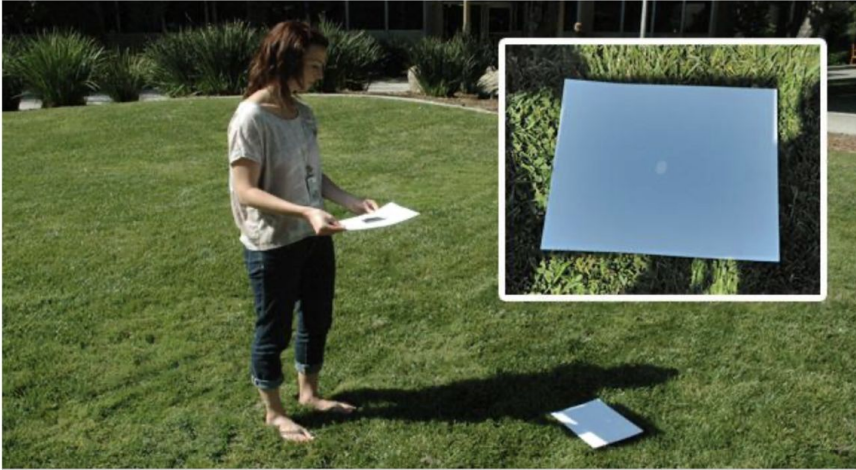
Pinhole Projector



3. Poke a hole in the foil

Use your pin or paper clip to poke a small hole in the aluminum foil.

Pinhole Projector



4. Try it out

Place your second piece of card stock on the ground and hold the piece with aluminum foil above it (foil facing up). Stand with the sun behind you and view the projected image on the card stock below! The farther away you hold your camera, the bigger your projected image will be.

To make your projection a bit more defined, try putting the bottom piece of card stock in a shadowed area while you hold the other piece in the sunlight.

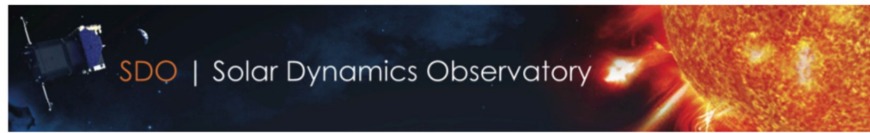
Place a second piece of white cardstock on the ground in front of you with your back to the Sun.

Foil-side-up, let the Sun shine through the hole, projecting the shape of the Sun on the piece of cardstock on the ground.



Solar Observations

Use the **solar eclipse glasses** and the **pinhole projector** to make observations of the Sun.



Solar Observations

Name: _____
Date: _____
Time: _____

Conditions Outside: (Circle all that apply)

Clear

Haze: Heavy Medium Light

Clouds: Heavy Medium Light Drifting Intermediate

Wind: Yes/No

Instruments used in observations:

**Record your data on the Solar
Observation Data Sheets.**



2023 & 2024 Solar Eclipse Map



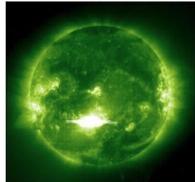
What color is the Sun?



Sample data for investigating the color of the Sun



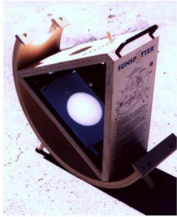
Sunrise



ESA/NASA SOHO image in EUV



Sun from space shuttle



SunSpotter™ image



Sunset



Sunset

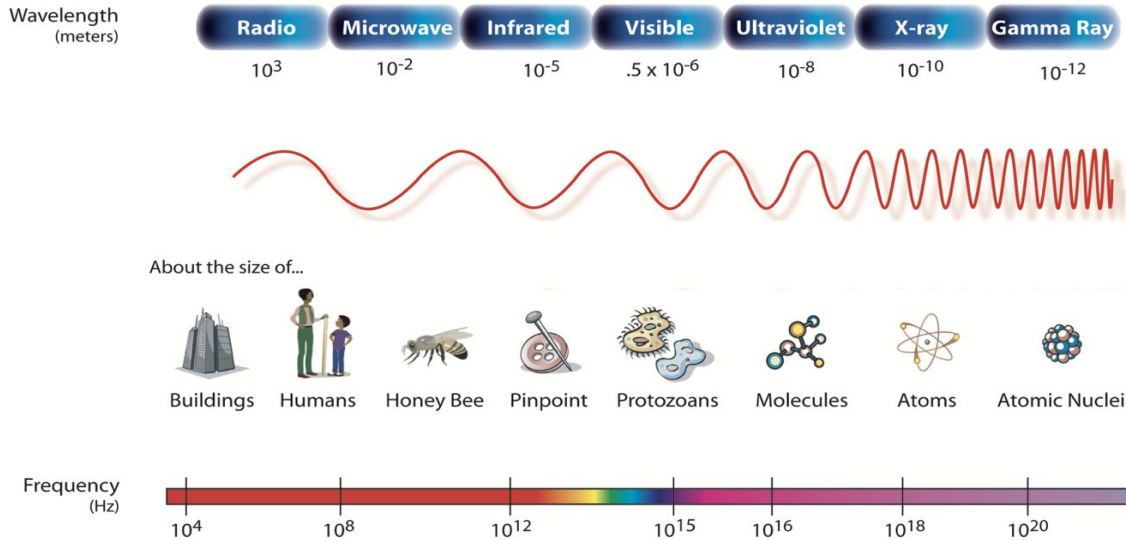


- ★ What colors are the Sun in these images?
- ★ Why is the Sun different colors in different images?
- ★ What color do you think the Sun is based on both your observations of the Sun outside and of these images? What is your reasoning?



The Sun emits radiation across ALL of the EM spectrum, you could say the Sun is all colors!

THE ELECTROMAGNETIC SPECTRUM



Credit: NASA / Afterschool Universe



Hubble Space Telescope

[Hubble Space Telescope Mission Homepage](#)

Primary: Visible Light



Image Credit: NASA, ESA



Image Credit: NASA, ESA, STScI; Image Processing: Alyssa Pagan (STScI)



Visible vs. Infrared Light: Hubble

Visible

Infrared



Different light gives scientists different information.

Record your observations.



[Explore Light with NASA's Hubble Space Telescope](#)

Credits: NASA, ESA, and M. Livio and the Hubble 20th Anniversary Team (STScI)



UV Light Investigation



You be the scientist!

UV Bead Worksheet

	Your prediction (Do you think the beads will be white, faint, or colored?)	Actual Color of Beads (white, faint, or colored)	Safe from UV?	Notes
Under water				
In sunlight				
In shadow				
Using sunscreen				
Cloudy sky <i>(i.e. no direct sunlight)</i>				

Record your observations on the data sheet.

- ★ Use the UV beads to experiment with UV light inside and outside, if possible.
- ★ Experiment with the invisible-ink pen, too, which has the same UV-reactive properties as the beads.



UV Bead/EM Spectrum Bookmark (optional)

The Electromagnetic Spectrum

Radio	$10^4 - 10^2$ cm	
Micro-wave	1 cm	
Infrared	10^{-2} cm	
Visible	10^{-5} cm	
Ultra-violet	10^{-6} cm	
X-ray	10^{-8} cm	
Gamma Ray	$10^{-10} - 10^{-12}$ cm	

Approximate size of

Our eyes can see visible light, the colors of the rainbow, but the Sun also gives off light our eyes cannot detect. Ultraviolet light is an invisible part of the Sun's electromagnetic spectrum. The Earth's ozone layer protects us from most of the Sun's dangerous UV, but too much can burn our skin, damage our eyes, and destroy our cells. These beads contain a special pigment that changes color when exposed to UV light. You can use them to detect UV/radiation and learn what best protects you from it.

LOCKHEED MARTIN
P70012 Book

UV DETECTING BEADS
SOLAR CENTER
STANFORD UNIVERSITY

Do your beads look white, faint, or colored in these? In which of these are you best protected from dangerous UV radiation?

- Under fabrics
- Under water
- Behind dark glasses
- Sunny day at noon
- Sunny day at sunset
- Cloudy weather
- Behind glass
- Under paper
- Electric Light
- Full sunlight
- Shade

For more information, visit: <http://solar-center.stanford.edu/activities/uv.html>

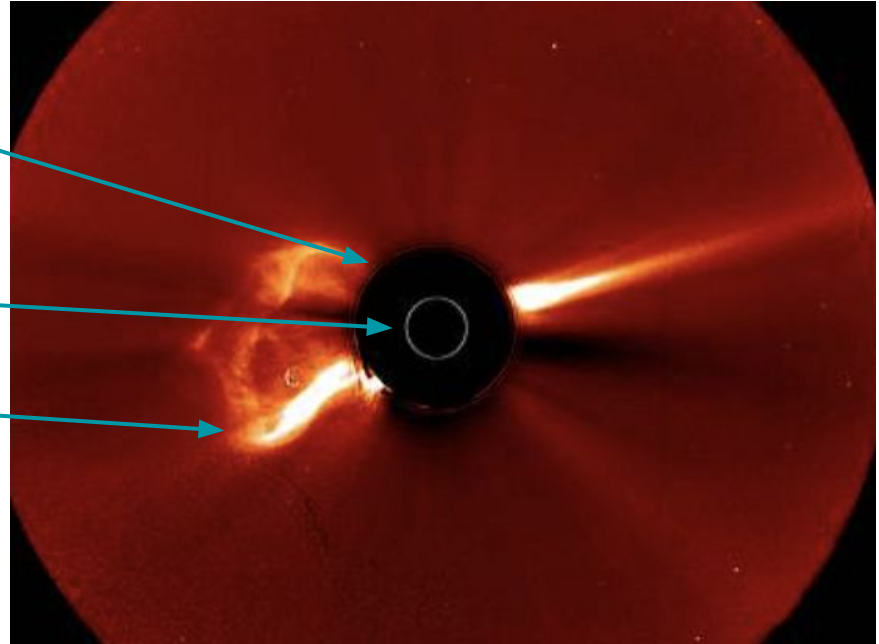


What is a coronagraph?

A **coronagraph** image blocks the Sun's bright surface (black circle).

Light orange circle shows the outline of the hidden Sun.

A **coronagraph** shows the features of the Sun's atmosphere, the corona.



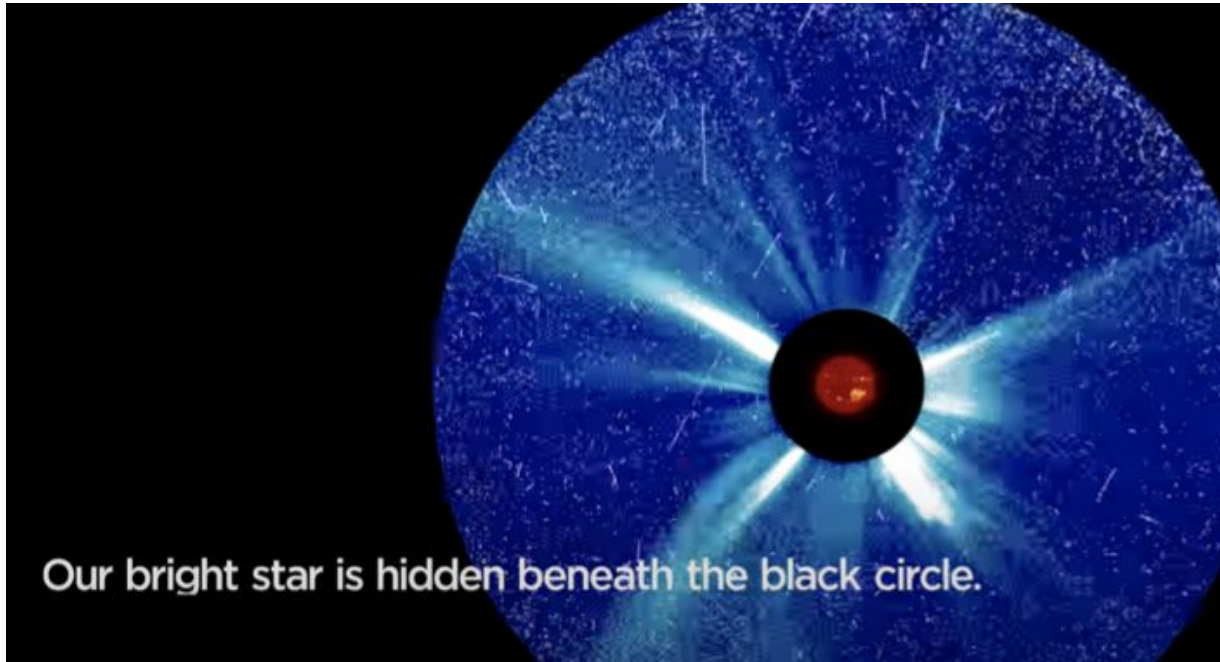
A coronagraph showing a CME Credit: NASA SDO



Video: NASA's STEREO Mission

[How to Read a NASA STEREO Image](#)

Coronagraphs allow us to view the Sun's corona.

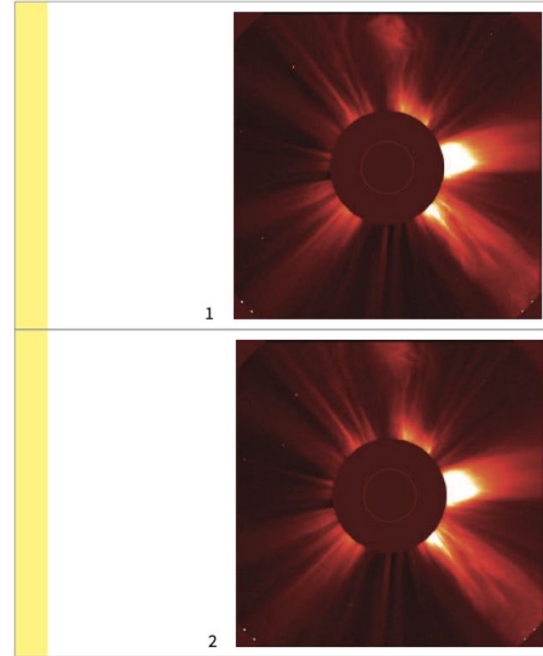


Our bright star is hidden beneath the black circle.

**Solar TERrestrial
RELations Observatory
(STEREO)**

Make a Coronagraph Flipbook of a Solar Flare

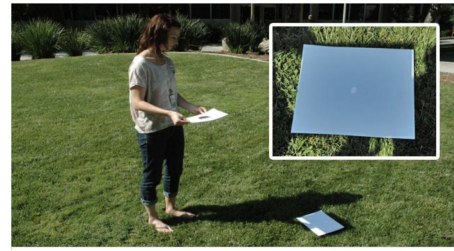
1. Cut out the images.
2. Put the images in order.
3. Clip the images together using the binder clip.
4. Flip through the book to see a solar flare in action!



Credit: DIY Sun Science / Lawrence Hall of Science / UC Berkeley

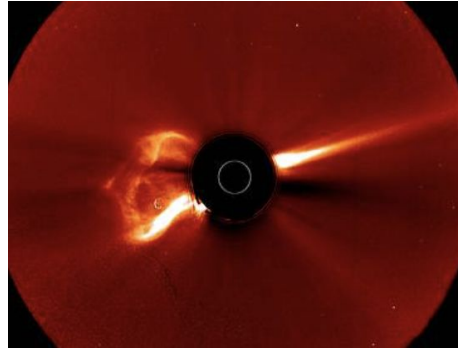


Reflect

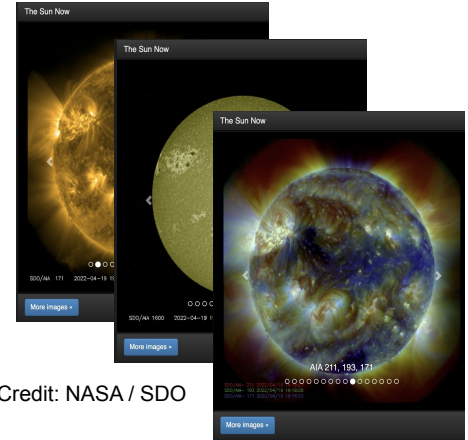


What advantages are there to making observations of the Sun using multiple methods?

Provide evidence for your claim.



A coronagraph showing a CME
Credit: NASA SDO



Credit: NASA / SDO



What did you learn about observing the Sun?

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Session 2 Major Concepts

- ★ The Sun is a star and is hard to observe because it is so bright.
- ★ Eye safety is important when observing the Sun. **Solar eclipse glasses** and **pinhole projectors** are safe methods for observing the Sun.
- ★ The Sun gives off all types of light on the **electromagnetic spectrum**. Humans can only see **visible light**.
- ★ A **solar eclipse** provides a great opportunity to make observations of the Sun.
- ★ Scientists make observations of the Sun in multiple wavelengths of light, which gives them more detail of different features of the Sun, like **solar flares** and **sunspots**.
- ★ The Sun's atmosphere is called the **corona**.
- ★ It is challenging to study the Sun's corona, because the Sun is so bright, and the corona is dimmer than the Sun's surface.
- ★ NASA uses **coronagraphs**, which use an occulting disk to block the Sun's light so that scientists can view the corona.
- ★ Using a coronagraph, scientists can observe features of the Sun, including the **solar wind** and **solar flares**.

