This Talk

Contains images of the Sun, Moon, and eclipses, as well as animations of those events.

Introduction to NASA, the Heliophysics Big Year, and Solar Research

Given By

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NASA/MSFC Heliophysics and Planetary Science Branch

Images Courtesy of: Jesse-Lee Dimech/Renee Weber (top left visible), Debra Needham (bottom left), Mitzi Adams (top right hydrogen alpha), Joe Matus (bottom right hydrogen alpha) -- NASA/MSFC

What is NASA?

National Aeronautics and Space Administration (NASA)

Ames Research Center	Moffett Field, CA
Armstrong Flight Research Center	Edwards, CA
Glenn Research Center	Cleveland, OH
Goddard Space Flight Center	Greenbelt, MD
Goddard Institute of Space Studies	New York, NY
IV and V Facility	Fairmont, WV
Jet Propulsion Laboratory (JPL)	Pasadena, CA
Johnson Space Center	Houston, TX
Kennedy Space Center	FL
Langley Research Center	Hampton, VA
Marshall Space Flight Center	Huntsville, AL
NASA HQ	Washington, D.C.
Stennis Space Center	MS
Wallops Flight Facility	Wallops Island, VA
White Sands Test Facility	Cruces, NM

Is NASA
Kennedy Space Center?

Who am I?
Mitzi Lynn Adams

From Atlanta, Georgia

- In high school, was an observatory/planetarium assistant at Fernbank Science Center
- Bachelor of Science in physics with a mathematics minor from Georgia State University
- Master of Science in physics from University of Alabama in Huntsville, in co-op program with NASA/MSFC
- Have been a NASA Solar Scientist since 1988
- Was planetarium director (a volunteer position) of the Von Braun Astronomical Society's planetarium from 1988-2006
- Have completed five marathons and observed five total solar eclipses
- Like to visit Peru in South America
- Like languages, Spanish, Latin, and German

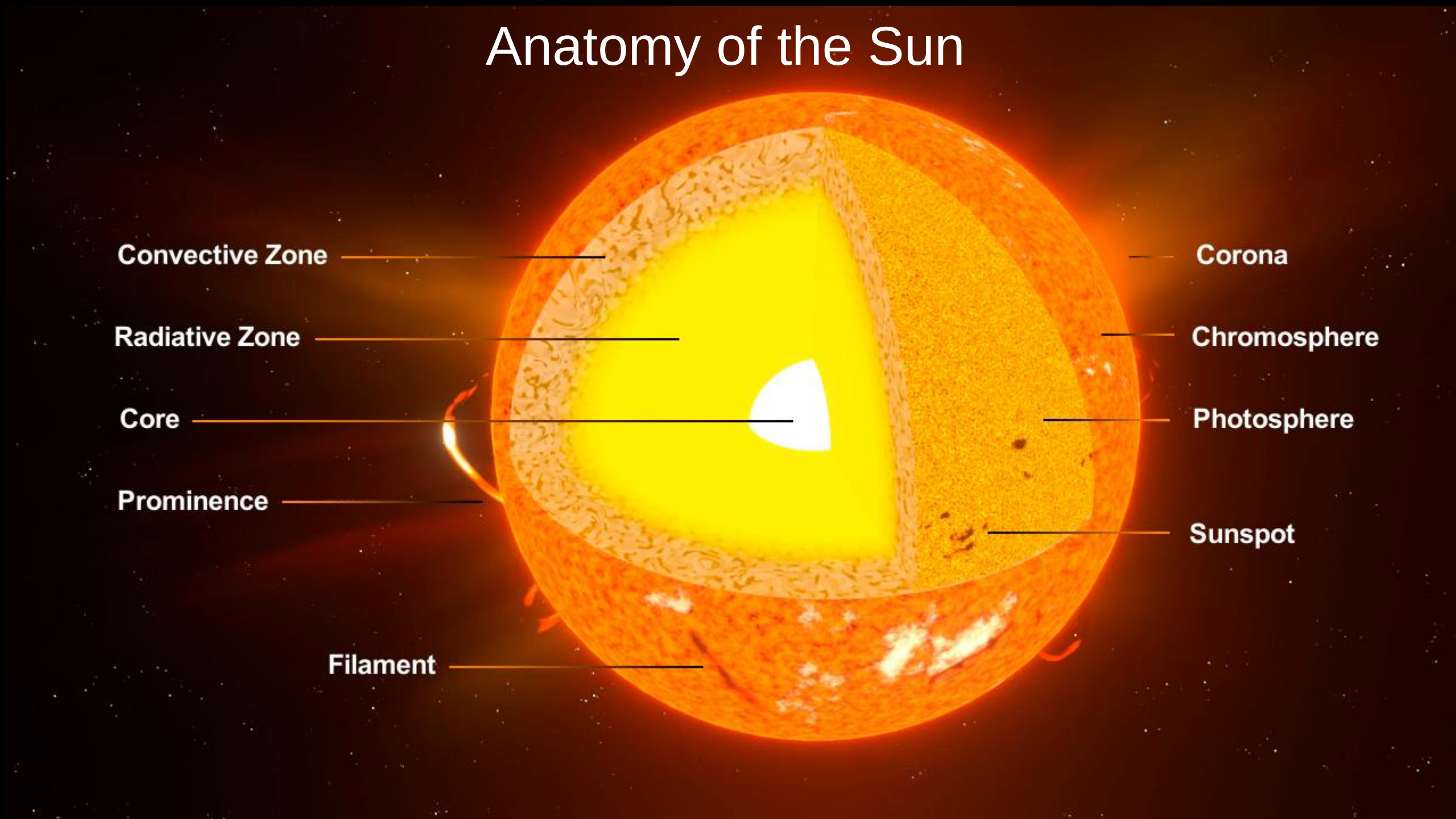
SIX

Heliophysics Big Year

NASA Heliophysics Big Year
Monthly Themes

MONTH	THEME	MONTH	THEME
Oct 2023	Annular Eclipse	May	Visual Art
Nov	Mission Fleet	Jun	Performance Art
Dec	Citizen Science	Jul	Physical and Mental Health
Jan 2024	Sun Touches Everything	Aug	Back to School
Feb	Fashion	Sep	Environment and Sustainability
Mar	Experiencing the Sun	Oct	Solar Cycle and Solar Max
Apr	Total Solar Eclipse	Nov	Bonus Science
		Dec	Parker’s Perihelion

Anatomy of the Sun



Carrington Observed a White Light Flare

Excerpt from: *Description of a Singular Appearance seen in the Sun on September 1, 1859*. by Richard C. Carrington, Monthly Notices of the Royal Astronomical Society, vol. 20, 13-15, 1860.

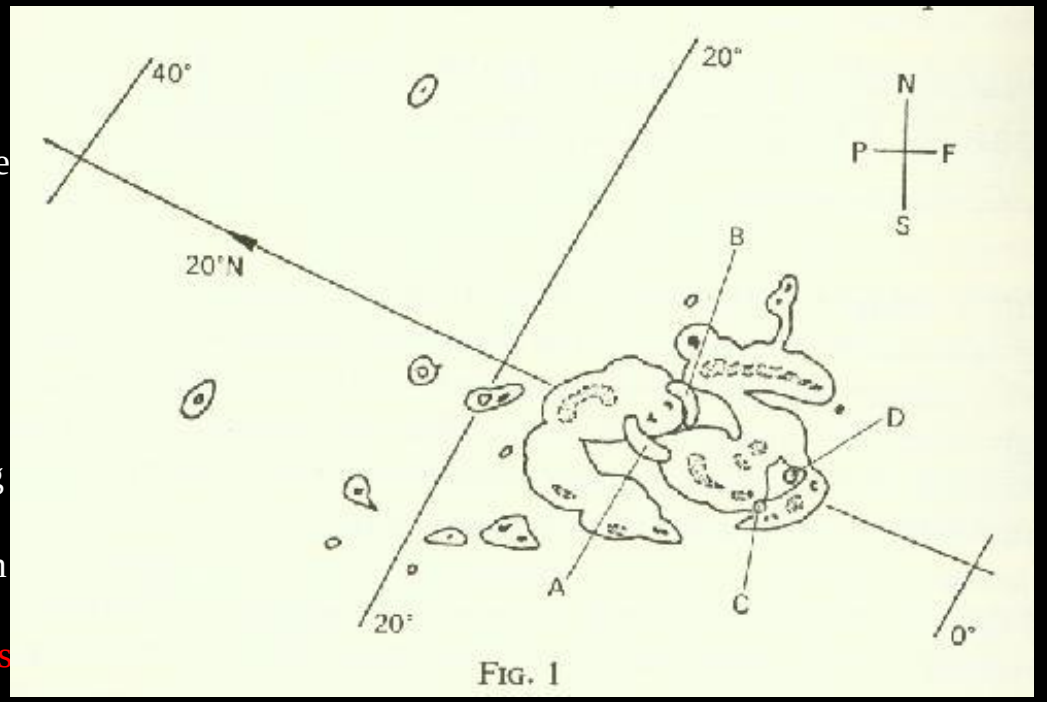


FIG. 1

While engaged in the forenoon of Thursday, September 1, in taking my customary observation of the forms and positions of the solar spots, an appearance was witnessed which I believe to be exceedingly rare. The image of the sun's disk was, as usual with me, projected on to a plate of glass coated with distemper of a pale straw color, and at a distance and under a power which presented a picture of about 11 inches diameter. I had secured diagrams of all the groups and detached spots, and was engaged at the time in counting from the chronometer and recording the contacts of the spots with the cross-wires used in the observation, when within the area of the great north group (the size of which had previously excited great remark), two patches of intensely bright and white light broke out, in the positions indicated in fig. 1 ... My first impression was that by some chance a ray of light had penetrated a hole in the screen attached to the object glass, for the brilliancy was fully equal to that of direct sun-light; but by at once interrupting the current observation, and causing the image to move ... I saw I was an unprepared witness of a very different affair. I therefore noted down the time by the chronometer, and seeing the outburst to be very rapidly on the increase, and being somewhat flurried by the surprise,, I hastily ran to call some one to witness the exhibition with me, and on returning within 60 seconds, was mortified to find that it was already much changed and enfeebled. Very shortly afterwards the last trace was gone. In this lapse of 5 minutes, the two patches of light traversed a space of about 35,000 miles.

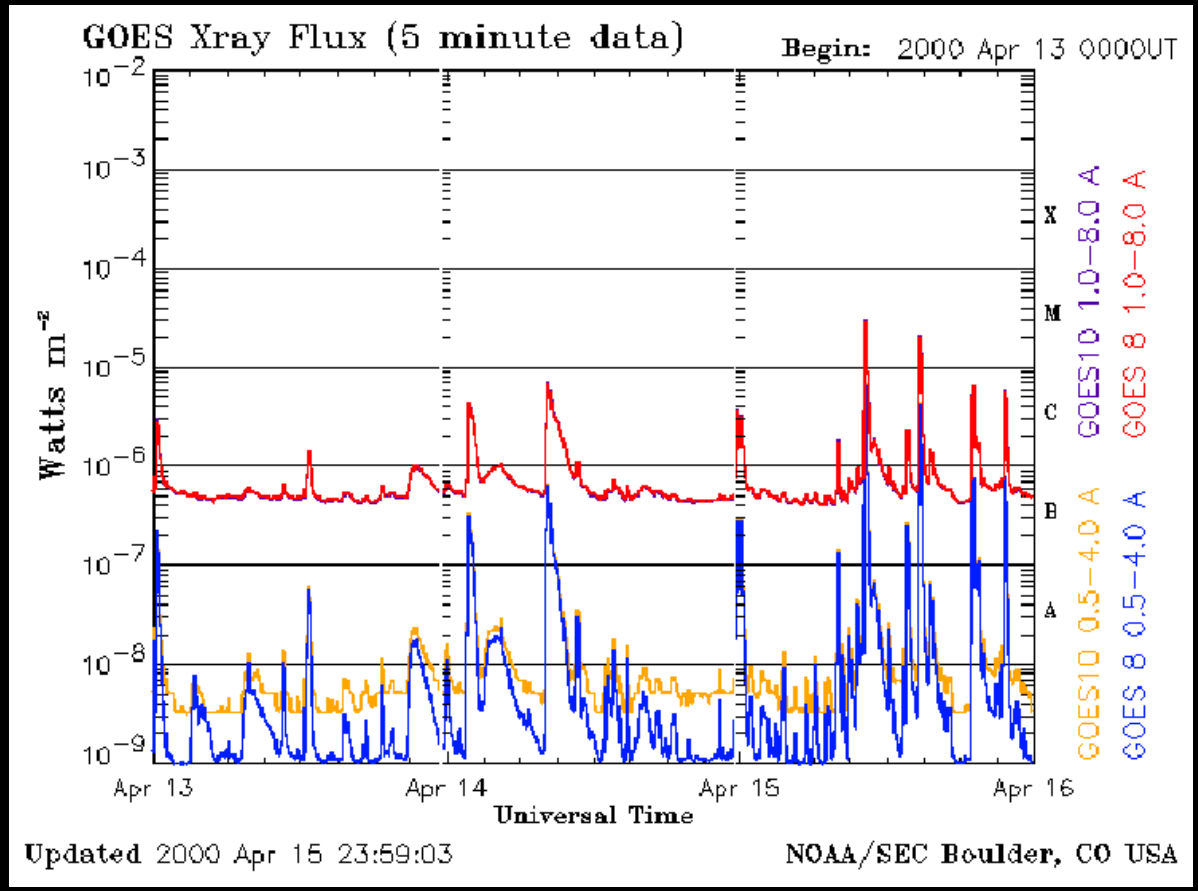
Physical Characteristics of Flares

How are Flares Classified?

Flares are classified according to the order of magnitude of the peak burst intensity (I) measured at the Earth in the 0.1 to 0.8 nm wavelength band as follows:

Class

B
C
M
X

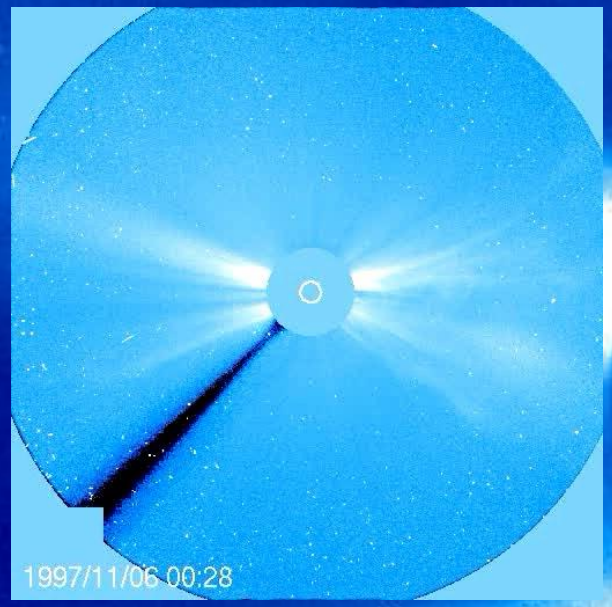


A multiplier is used to indicate the level within each class. For example,

M6 = 6 x 10^{-5} Watts/m^2

Effects of a CME in Space

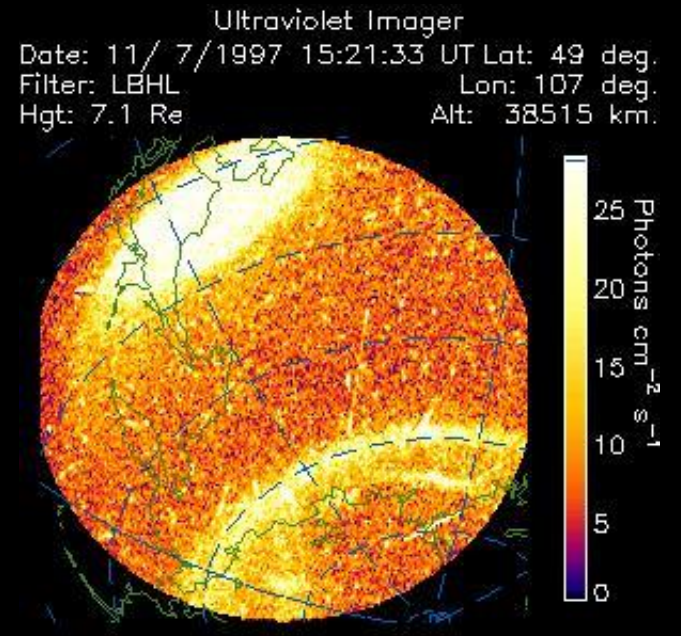
On November 6, 1997, *this* CME originated from an X-9.4 flare.

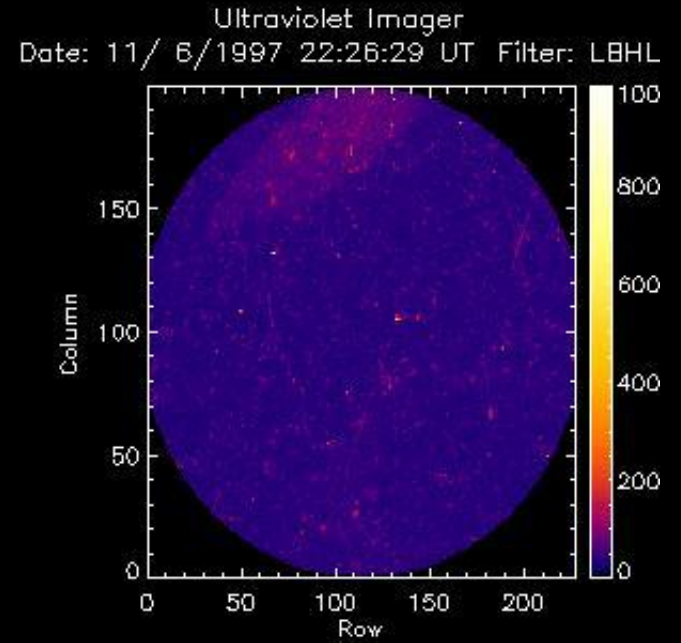


One hour later, energetic particles arrive at the location of SOHO. The photos are from the Large Angle and Spectrometric Coronagraph (LASCO) C3 instrument.

Effects of a CME at the Earth...

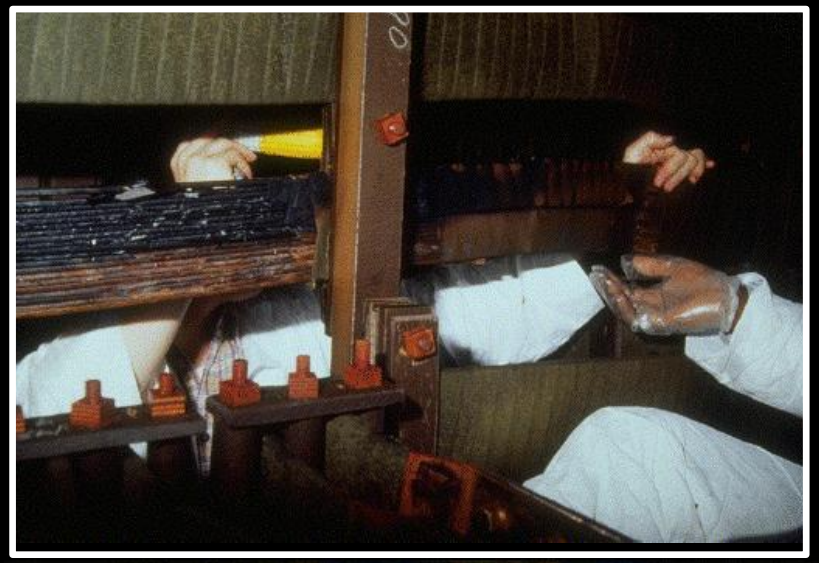
The Aurorae



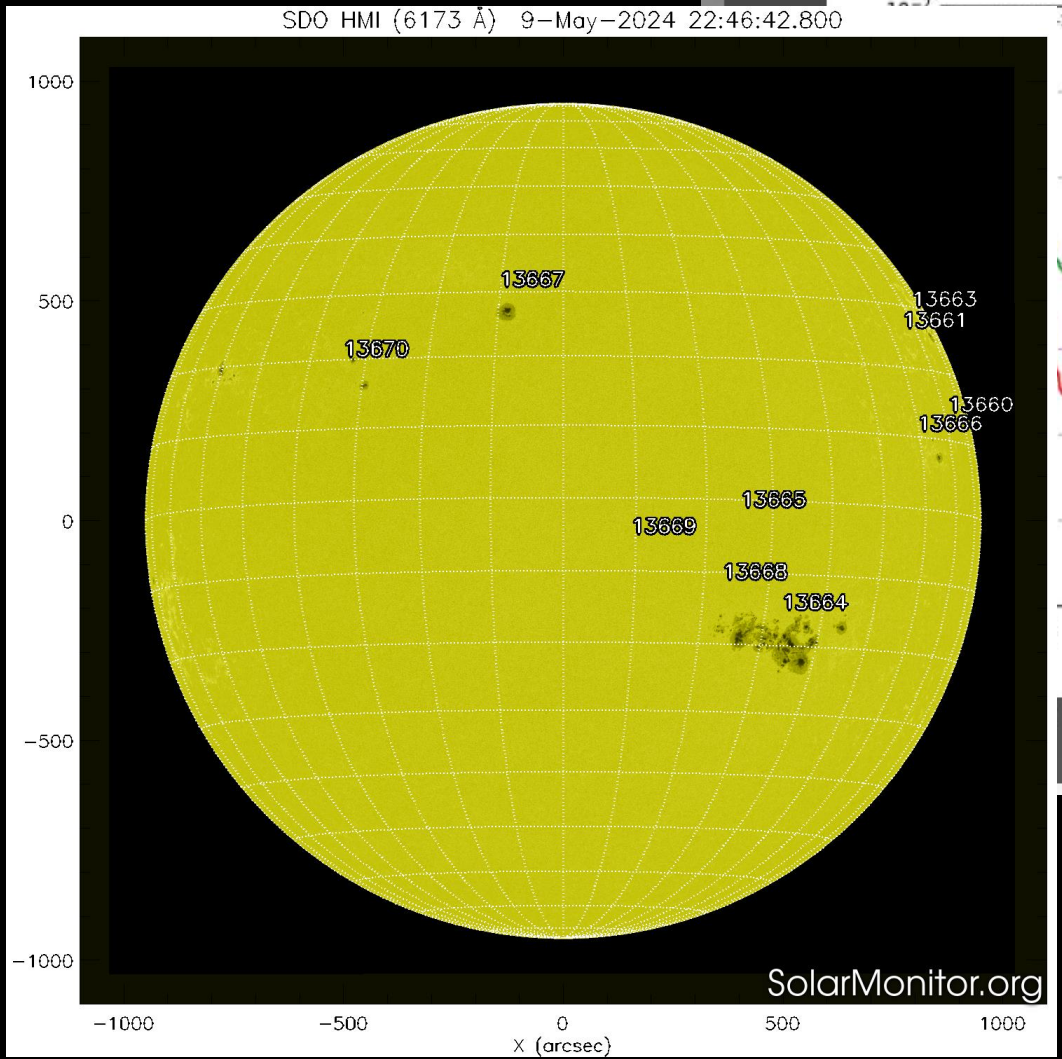


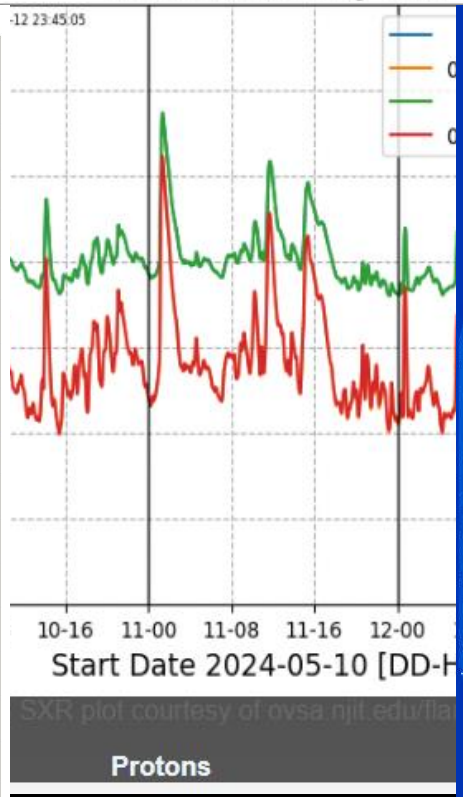
Effects of a CME at the Earth

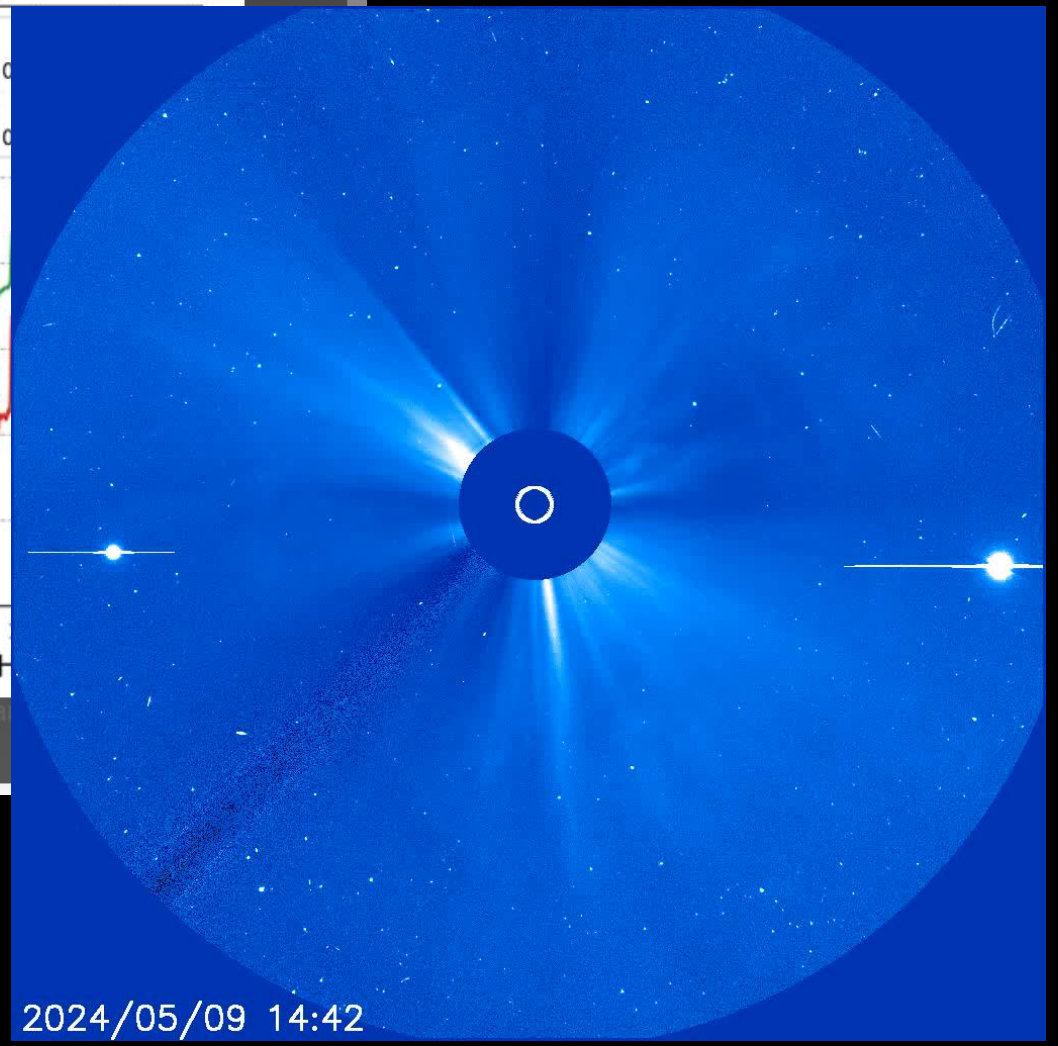
1989 -- On March 13, a solar induced magnetic storm caused a disruption of power in Quebec. Service restoration took over nine hours.



More Recently…







Aurorae: Image by Linda Rawlins, Kennamer, AL

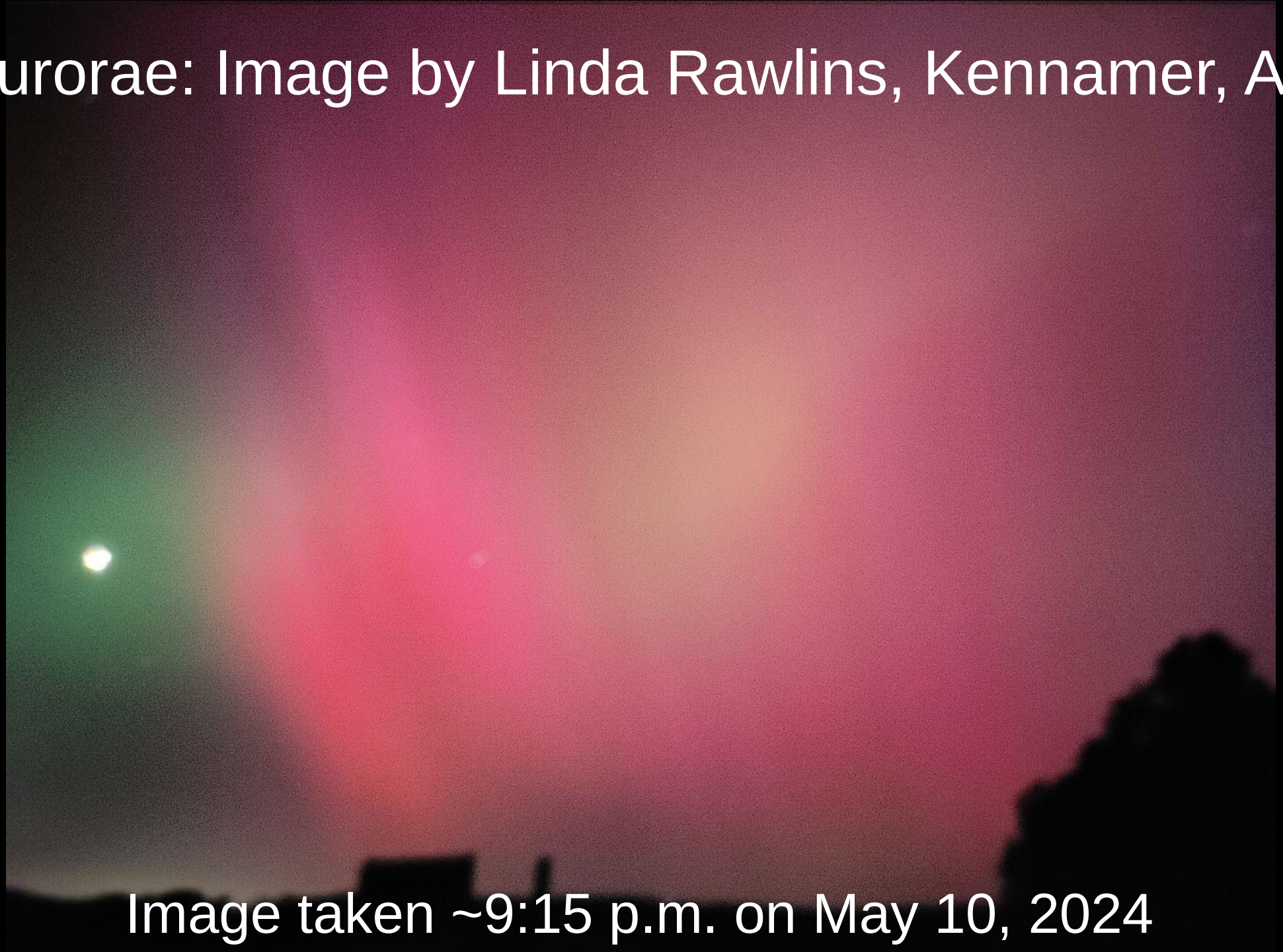
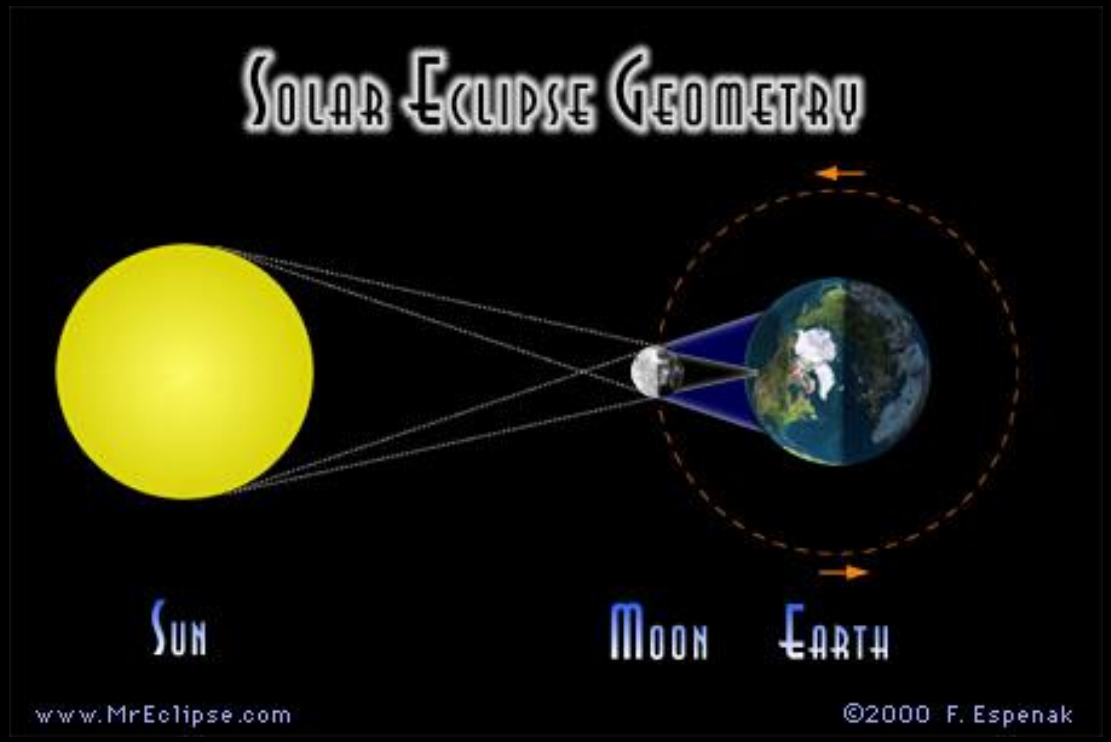


Image taken ~9:15 p.m. on May 10, 2024

What is an Eclipse?

An eclipse happens when one object blocks the light of another



Images Used With Permission

Annula g Ring

Diagram source:
https://space.rice.edu/e
eclipse_graphics.html

n Annular Eclipse is a Partial Eclipse with Good Press

Image Source: NASA/Bill D
Published: October 12, 202
Historical Date: May 20, 20
An annular solar eclipse ph
From: https://solarsystem.n
2012-annular-eclipse/?ann

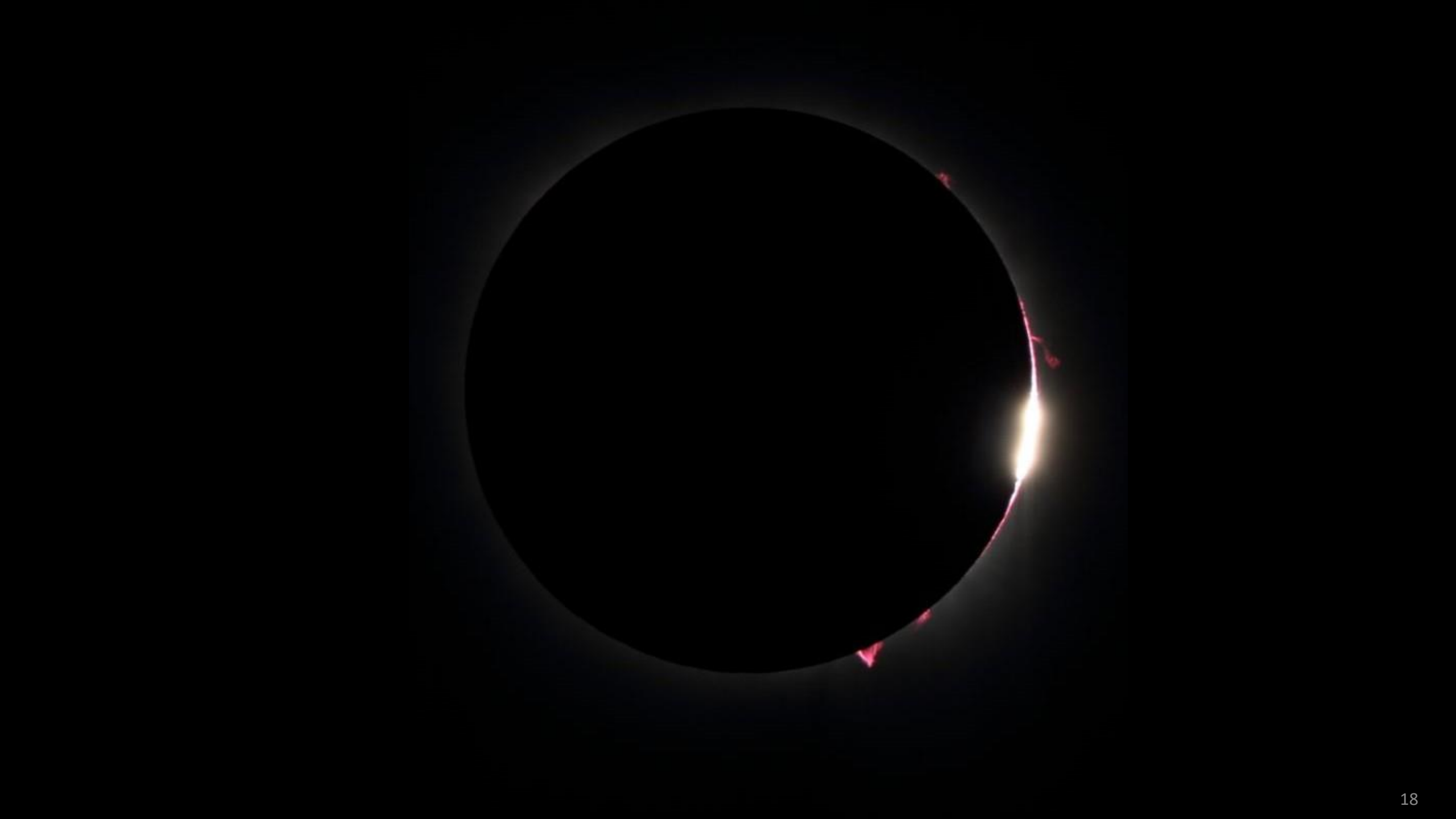


Image by Solar System Ambassador
Derek Wallentinsen from Eagle Pass, TX

Image by NASA retiree Linda Rawlins
from Mansfield, TX

Questions?

Back-up Slides

NASA Science for the 2024 Total Solar Eclipse

NASA and partners have many projects that seek to involve scientists, citizen scientists, students, and the general public:

- Globe Observer: Study Earth's atmosphere as the Moon's shadow passes over a location
- HamSci, Radio Jove, The INSPIRE Project: Study radio waves and compare with night-time data [https://hamsci.org/projects, https://science.nasa.gov/news/citizenscience/join-radio-joves-solar-eclipse-campaign, https://theinspireproject.org/]
- iNaturalist: Study animal and plant behavior [https://www.inaturalist.org/]
- Study the Moon's edges (limb) by comparing lunar-orbiter-derived maps with ground-based photography
- The Dynamic Eclipse Broadcast (DEB) Initiative: Documenting the Corona Moment by Moment; led by Bob Baer and Matt Penn, Southern Illinois University, Carbondale, Illinois; will use both on and off path-of-totality images [https://debinitiative.org/]
- Citizen Continental-America Telescopic Eclipse (CATE) 2024: Led by Amir Caspi, Southwest Research Institute; will record polarization of coronal light (coronal structure and solar wind) [https://eclipse.boulder.swri.edu/]
- Eclipse Megamovie 2024: Recording Dynamics Across the Corona: Led by Laura Peticolas of Sonoma State University (chromosphere and corona) [https://science.nasa.gov/citizen-science/eclipse-megamovie-2024/]
- Super Dual Auroral Radar Network (Super DARN): Led by Bharat Kunduri (bharatr@vt.edu), Virginia Polytechnic Institute and State University; three SuperDARN radars will study the ionosphere
- Solar Patrol Citizen Science Program: Led by Thangasamy Velusamy, Lewis Center for Education Research; will study radio emissions from sunspots [https://gavrt.lewiscenter.org/Campaigns/Solar-Patrol/index.html]
- SunSketcher 2024: led by Gordon Emslie of Western Kentucky University; will use SunSketcher 2024 app to capture views of eclipse; focus is on the shape of Sun [https://sunsketcher.org/]
- GeoCollaborate: Sharing eclipse data for broadcasting and educators; led by StormCenter Communications, funded to use software application to widen access to eclipse-science data [https://edu.geocollaborate.com]