



HELIOPHYSICS BIG YEAR


Join us **Oct. 2023**
to Dec. 2024 for a
global celebration
of solar science
and the Sun's
influence on Earth
and the entire solar system.



Visit go.nasa.gov/HelioBigYear
to learn more!

Back Cover

2 solar eclipses
1 active Sun
JOIN
the celebration!



Front Cover



reverse
the
polarity
time!

The Sun is a huge magnet.
Every 11 years, the Sun
reverses its poles. This causes

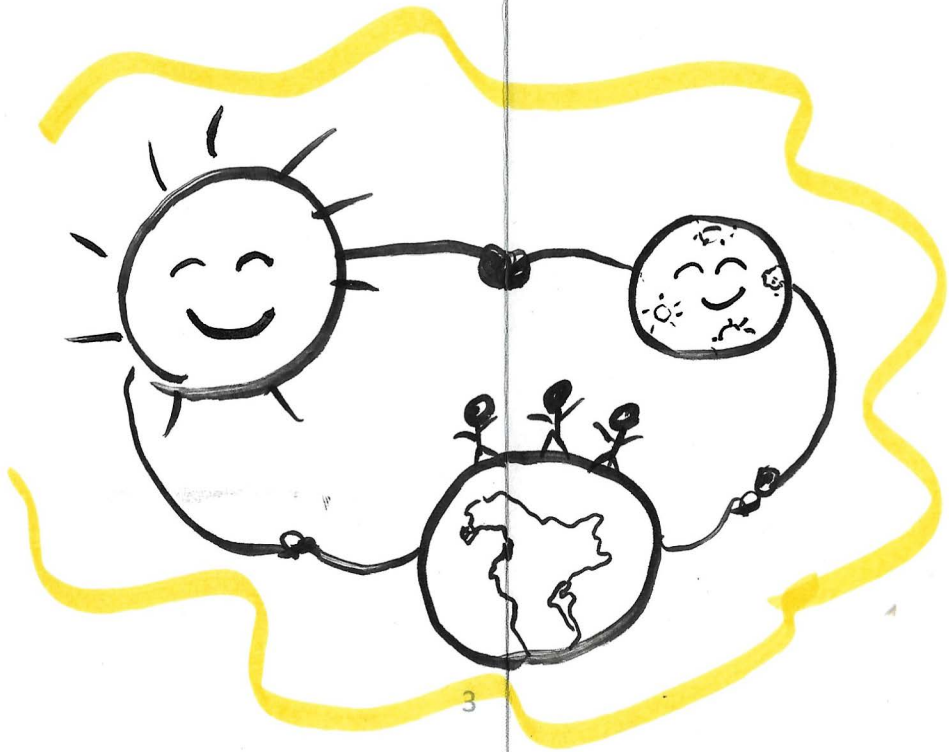
active times + quiet times.
We are heading into an active
time!

HELIOPHYSICS

the study of the
Sun + everything
it affects

BIG YEAR

from birding,
trying to do as
many of a thing
as possible in 1 year



As the Sun gets
more active it can
send storms that
cause beautiful
Northern + Southern
Lights, as well as
affect large tech
grids. Learning
more about this
is important!



5

Join the Helio
Big Year to
celebrate the
Sun in an
active time +
enjoy 2 different
solar eclipses!



6



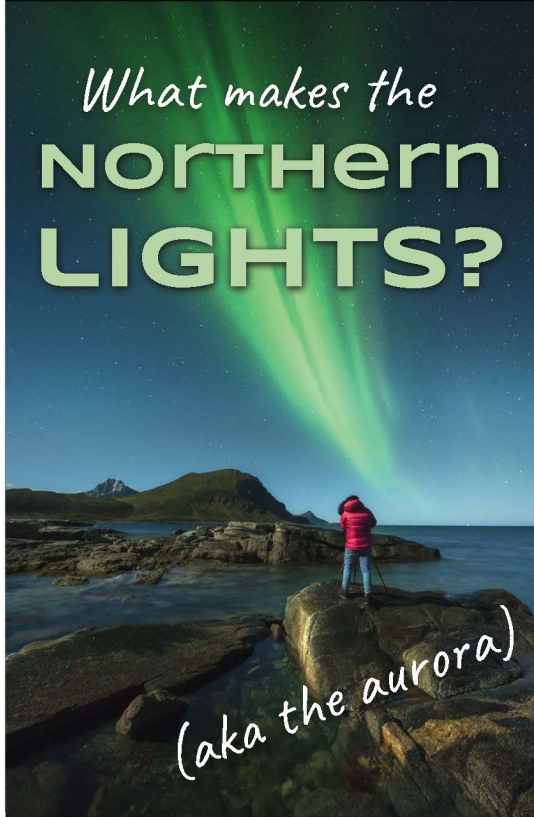
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What makes the
**NORTHERN
LIGHTS?**



(aka the aurora)

electrons hit
air molecules



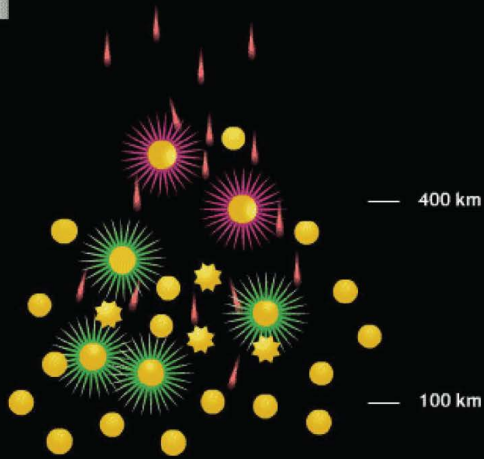
molecules
are "excited"



molecules
give off light as
they calm down



Diagram: NASA

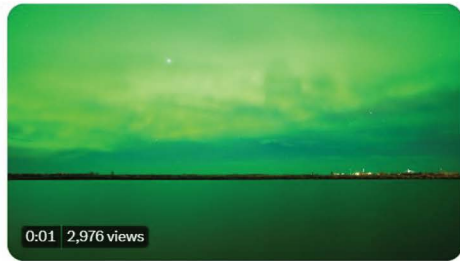


Auroras are made of many tiny flashes of light produced by high energy particles in the Earth's upper atmosphere.

Did you know?
There are names for
different aurora patterns.

 Vincent Ledvina ✓ @Vincent_Ledvina · Dec 20, 2022 ...
Pulsating aurora (my favorite kind of **aurora**) fills the sky in Churchill as the next substorm gears up! Sometimes it takes hours for the **aurora** to recover and get ready to dance again, like an intermission for a second act!

[#aurora](#) [#northernlights](#)



Have you met
STEVE?

Did you know?
citizen scientists discovered
a new kind of aurora that
they called STEVE.

awesome sauce is
Green



Jack Fischer ✓
@Astro2fish

...

People have asked me what a “burrito of awesomeness smothered in awesome sauce” is... Well folks, it looks like this...awesome sauce is green.



0:41 311.4K views

Aurora from the International Space Station

Time-lapse imagery as we fly through the amazing aurora 250 miles above at 17,500 mph.

You can help!

Join the chase and take photos of aurora with Aurorasaurus.org

Find patterns in aurora photos with the North Dakota Dual Aurora Cameras (NoDDAC) on Zooniverse.org (coming soon!) 6

2:59 PM · Jul 23, 2017



We are seeking volunteers
regardless of age or
experience.

Interested? Contact us!
cate@boulder.swri.edu

**DID YOU KNOW THE
CORONA WE SEE IN THE
ECLIPSE IS STILL A
MYSTERY?**

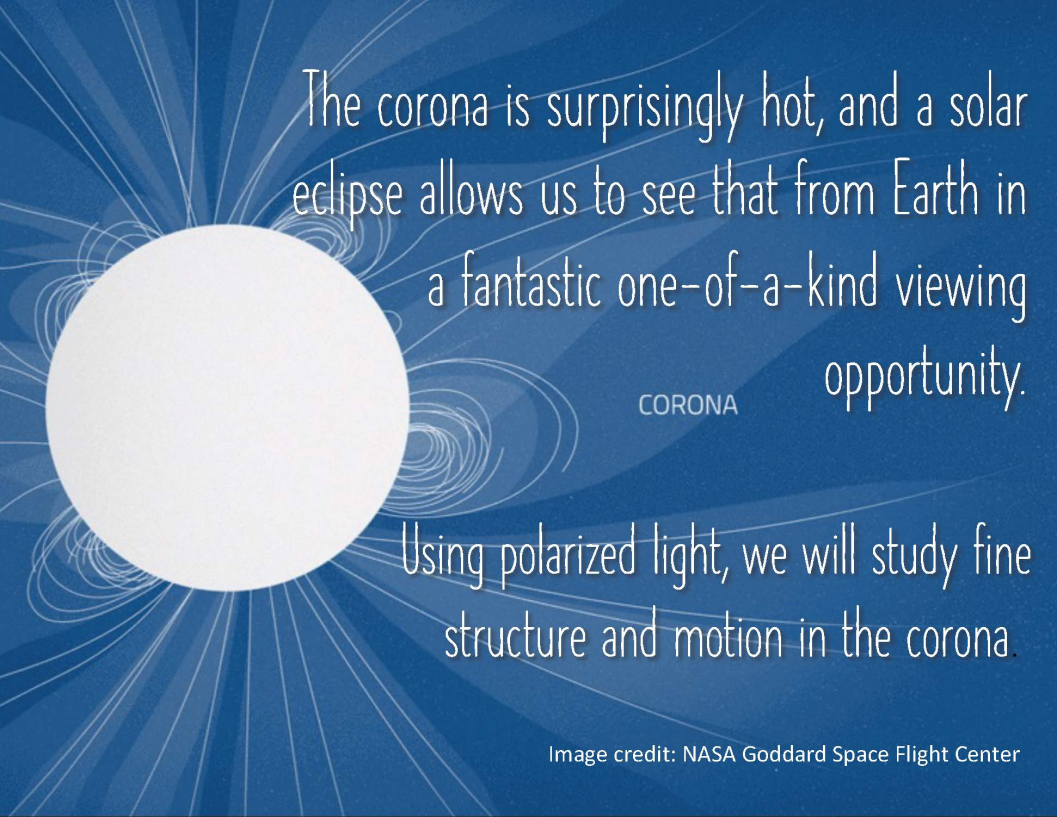


The Citizen Continental America
Telescopic Eclipse (CATE) Next-
Generation 2024 Experiment

During a solar eclipse, the moon blocks the sun, allowing us to see the sun's outer atmosphere (the corona).



In the corona we can see the structure of the sun's complex magnetic field and the hot plasma flowing out of the sun.



The corona is surprisingly hot, and a solar eclipse allows us to see that from Earth in a fantastic one-of-a-kind viewing opportunity.

CORONA

Using polarized light, we will study fine structure and motion in the corona.



**YOU CAN BE PART OF
TEAMS HELPING TO
SOLVE THE MYSTERY OF
THE HOT CORONA!**

During the 2024 eclipse, CATE will take a 60-minute video of the solar corona with 35+ groups of citizen scientists along the US eclipse path.



space physics research

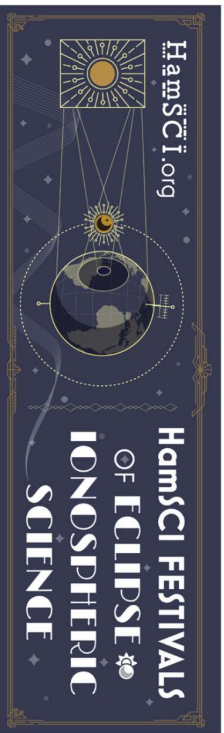
into the realm of

ham radio operators

Welcoming

Ham Radio Science Citizen Investigation

IONOSPHERE



Join us in **Oct. 2023** and **Apr. 2024** for HamSCI's FOEIS.

Thousands of amateur (ham) radio operators doing what they do best - communicating via radio - generating data for solar eclipse-based space physics research.

Visit hamsci.org/eclipse to learn more!

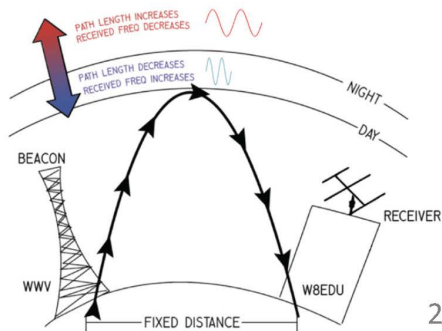


HELIOPHYSICS BIG YEAR

HamSCI and its members are excited to offer numerous **Heliophysics Big Year** events, including ham radio competitions and research opportunities. All will utilize the skills available in the ham radio community.

1

HamSCI members will be studying 'space weather' during the upcoming North American solar eclipses. We will be monitoring the eclipses' effects on the ionosphere, the region of charged particles existing 80 to 300 km above our heads.



2



HamSCI members will be transmitting and receiving shortwave radio signals before, during and after the eclipses, generating millions of data points for later analysis.

Many participants will utilize their existing equipment.



However, hams, long known for building their own gear, are encouraged to assemble *Personal Space Weather Stations (PSWS)*, designed by HamSCI.

The simplest PSWS is the *Grape 1*. It is a user-built printed circuit board radio that is connected to the Web via a Raspberry Pi, allowing for data collection on a 24/7 basis.



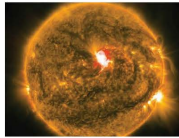
5

More complex, commercially produced versions of the PSWS are under development. The goal is to present a range of experiences and cost points to citizen scientists. See hamsci.org/psws for details.

Summary

HamSCI's researchers have long utilized the skills of Amateur (ham) Radio Service licensees to advance space physics knowledge. The HBY presents many more collaboration opportunities.

6



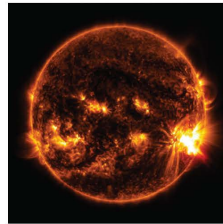
NASA/SDO



Do you want to become
a solar radio observer?

Join Radio JOVE:
radiojove.gsfc.nasa.gov

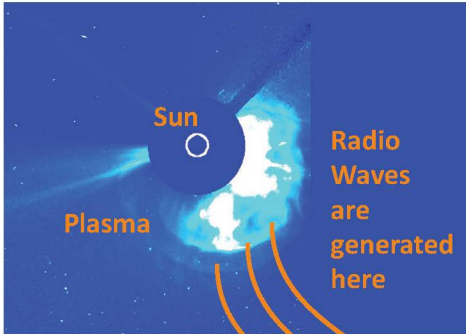
Contact Chuck Higgins:
chiggins@mtsu.edu



NASA/SDO

*Have
you
heard
the Sun?*

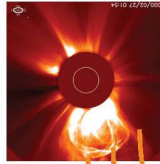




Coronal Mass Ejection (CME) with outgoing shock [NASA/SOHO]

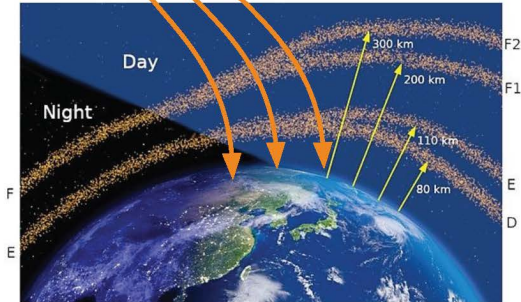
Solar Radio waves are caused by moving charged particles (plasma).

An active Sun causes many radio waves.



NASA/SOHO

Solar radio waves are electromagnetic waves that travel at the speed of light to the Earth.



Depiction of the nighttime and daytime ionosphere [C. Molina]

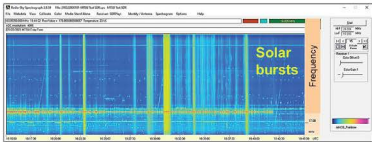
Solar radio waves can be detected using simple radio telescopes.



Dual Dipole Radio Antenna
12 m (40 ft) x 9 m (30 ft)



SDRplay*
RSP1A Radio
Receiver



Computer with Radio-Sky Spectrograph Recording Software

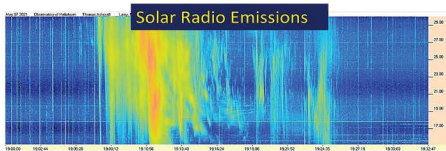
Radio JOVE Dual Dipole antenna, SDRplay RSP1A receiver, and Radio-Sky Spectrograph (RSS) software. [Kit Cost = \$220 + shipping + \$120 antenna support structure (computer is not included)]. *SDRplay (www.sdrplay.com) is a UK-based company that manufactures Software Defined Radio (SDR) radios. Radio-Sky Spectrograph software from radiosky.com.

Electromagnetic radio waves are not sound waves. However, like a radio station transmitter they can be converted to sound waves.

Uploader	Date	View Count
ACJ-10018	Aug 22, 14	1,012
ACJ-10018	Aug 22, 14	1,012
ACJ-10018	Aug 22, 14	1,012
ACJ-10018	Aug 22, 14	1,012
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ACJ-10018	Aug 22, 14	1,012
ACJ-10018	Aug 22, 14	1,012
ACJ-10018	Aug 22, 14	1,012
ACJ-10018	Aug 22, 14	1,012

OFFICIAL RADIO JOVE ASTRONOMY SPECTROGRAPH LIVE YOUTUBE STREAM - Hosted by K4LED

Radio data are color displayed as a 15-30 MHz radio frequency vs time spectrogram.



Solar Radio Bursts, May 7, 2021
[T. Ashcraft, New Mexico]

You can set up and use your own radio telescope.

Science Question: How do solar eclipses affect radio waves through the ionosphere?



Map of Radio JOVE Telescope Sites
Radio JOVE needs people to observe the 2023 and 2024 solar eclipses.



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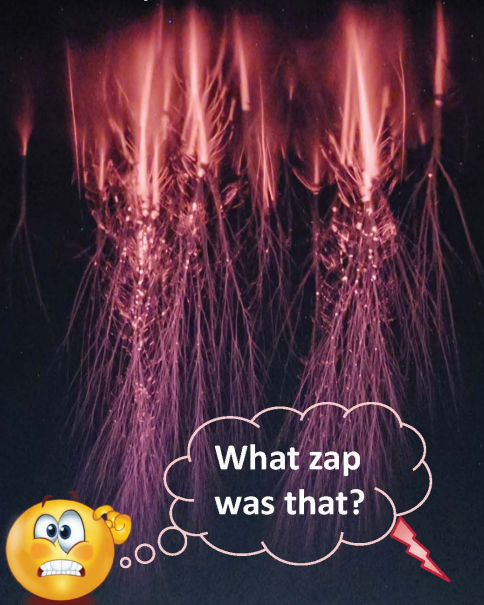


Spritacular



Partner

A Citizen Science Project Studying
Electricity Above Thunderstorms

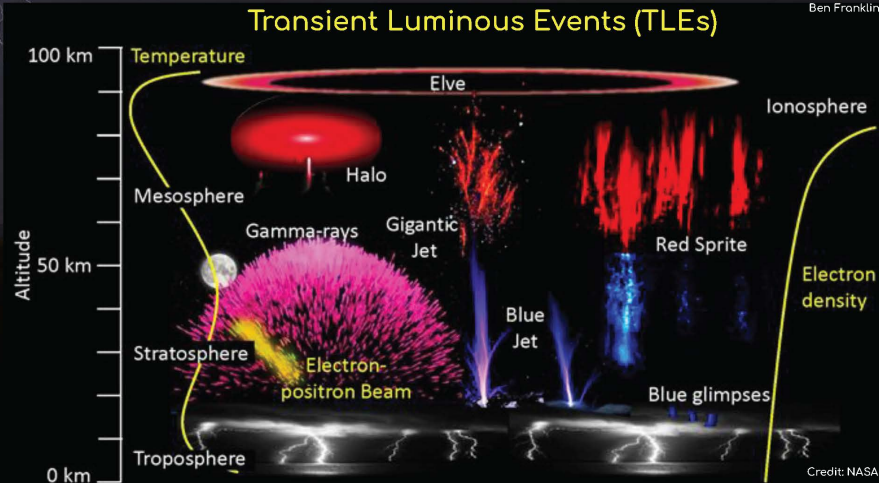


To this day, lightning still remains a mystery, long after Ben Franklin's kite experiment in 1752...

The more we study the electrical nature of thunderstorms, the more we learn about their magic.



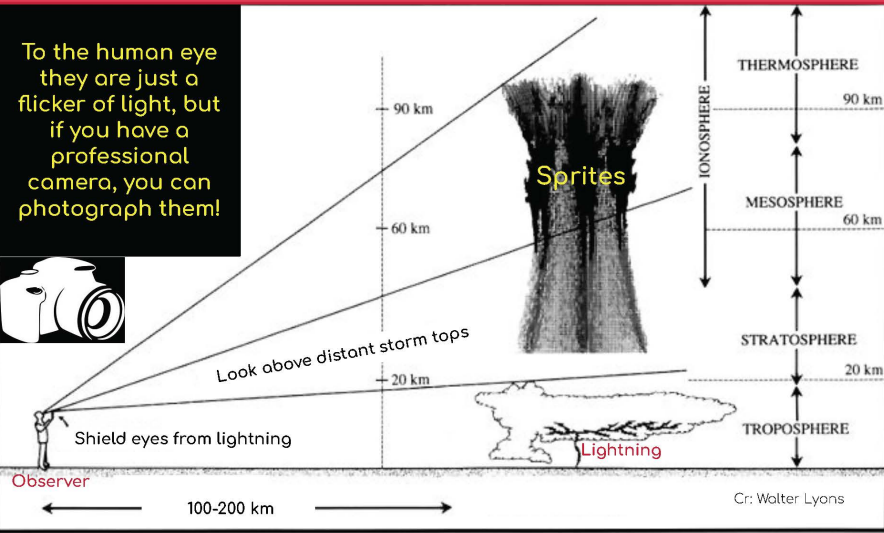
Ben Franklin



The region of space above the thunderstorms is a zoo of electrical activity!
Collectively they are known as Transient Luminous Events (TLEs).

How to look for Transient Luminous Events (TLEs)! Here is an example for Sprites

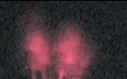
To the human eye they are just a flicker of light, but if you have a professional camera, you can photograph them!



Jellyfish Sprite



Column Sprite



Carrot Sprite



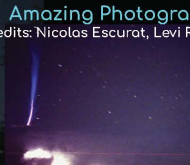
Angel Sprite

Amazing Photographs from Citizen Scientists all around the world!

(Credits: Nicolas Escurat, Levi Riggins, Martin Popek, Oscar van der Velde, Frankie Lucena, Patrick Huet)



Gigantic Jet



Blue Jet



Sprite & Halo



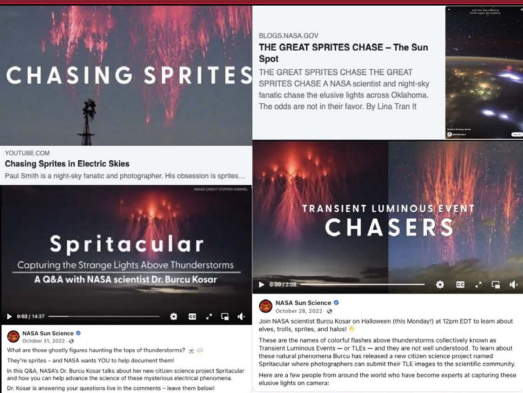
ELVEs



Halo

“Scientist - Citizen Scientist Partnership” : A sprite chasing campaign in Oklahoma!

You Can Help Advance NASA Science!



Spritacular (pronounced *sprite-tacular*) leverages the power of crowdsourcing to advance the science of sprites and TLEs!



@spritacular

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



Join the Chase
from the ground!

Engage with our community!



A night of
adventurous
chasing...

Left to Right: Paul Smith, Lina Tran, Burcu Kosar (top), Joy Ng (bottom), and Terrill Graham.

...ends with capture of column sprites!