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

Front Cover

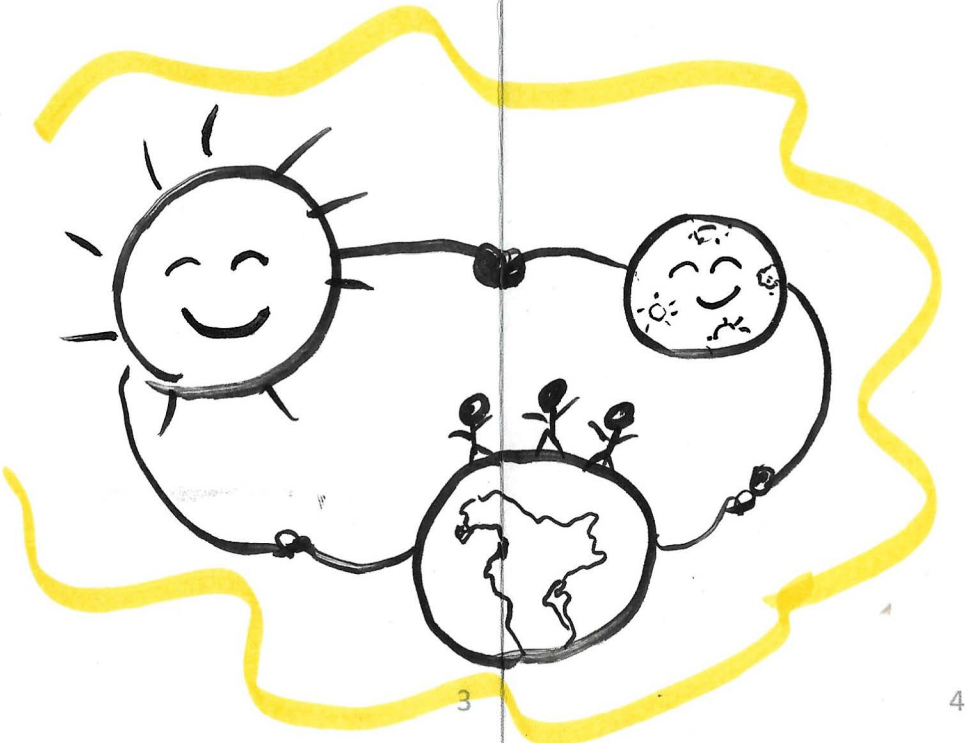
The Sun is a huge magnet. Every 11 years, the Sun reverses its poles. This causes active times + quiet times. We are heading into an active time!

HELIOPHYSICS

the study of the Sun + everything it affects

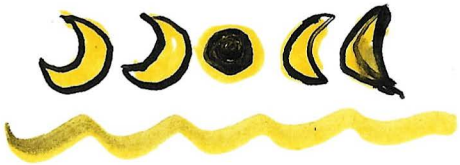
BIG YEAR

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!

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



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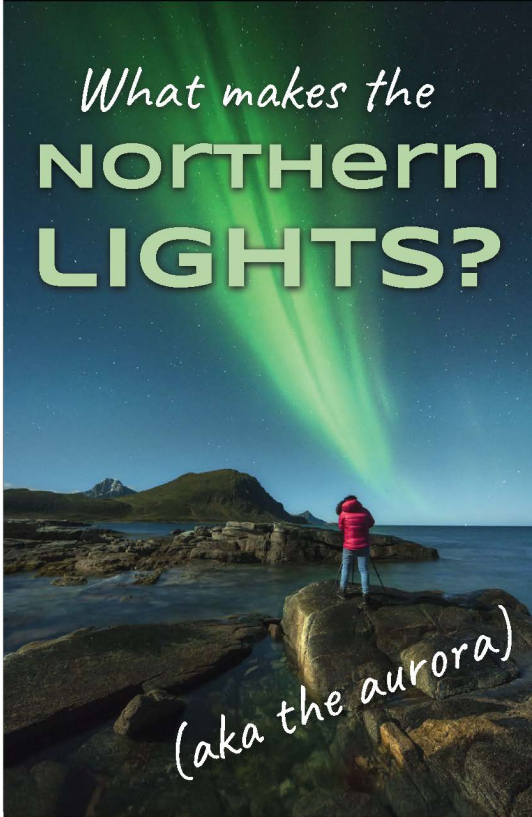
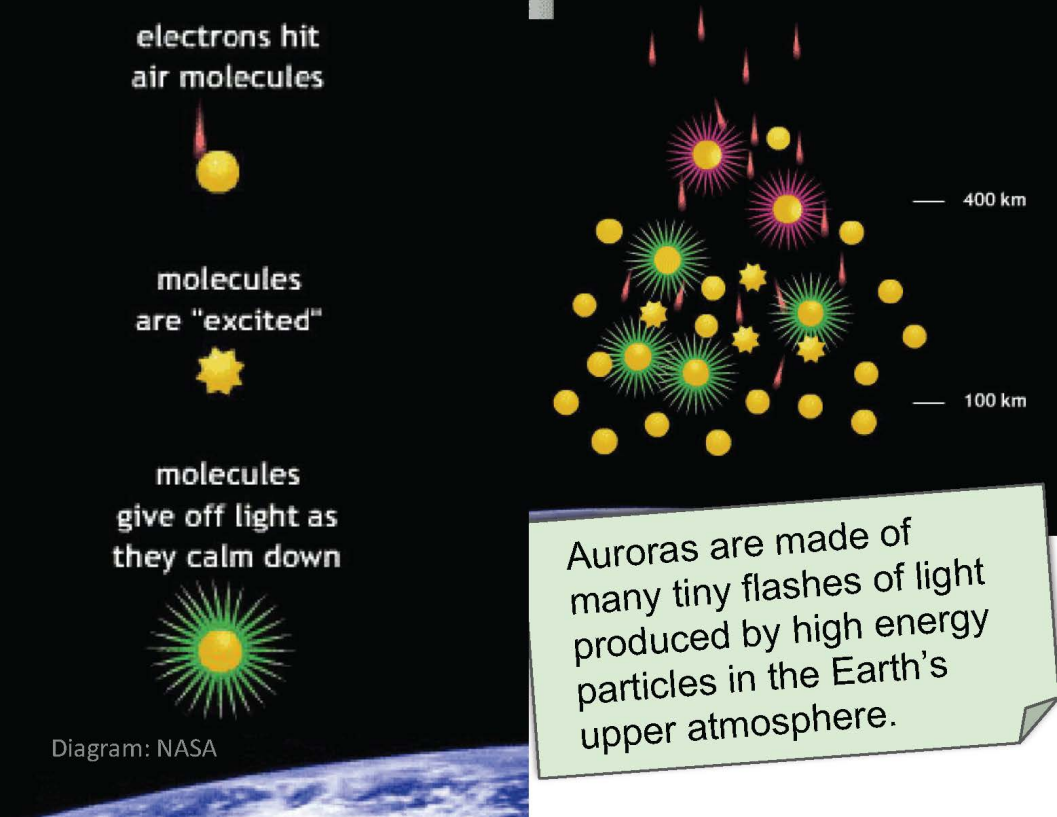




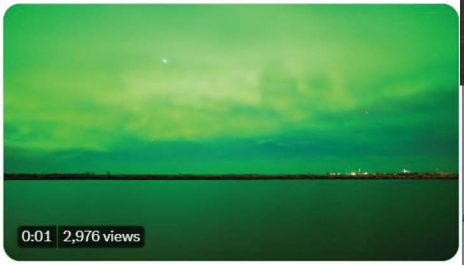
Auroras are made of many tiny flashes of light produced by high energy particles in the Earth's upper atmosphere.

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



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.

Aurora from the International Space Station

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

2:59 PM · Jul 23, 2017

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!)

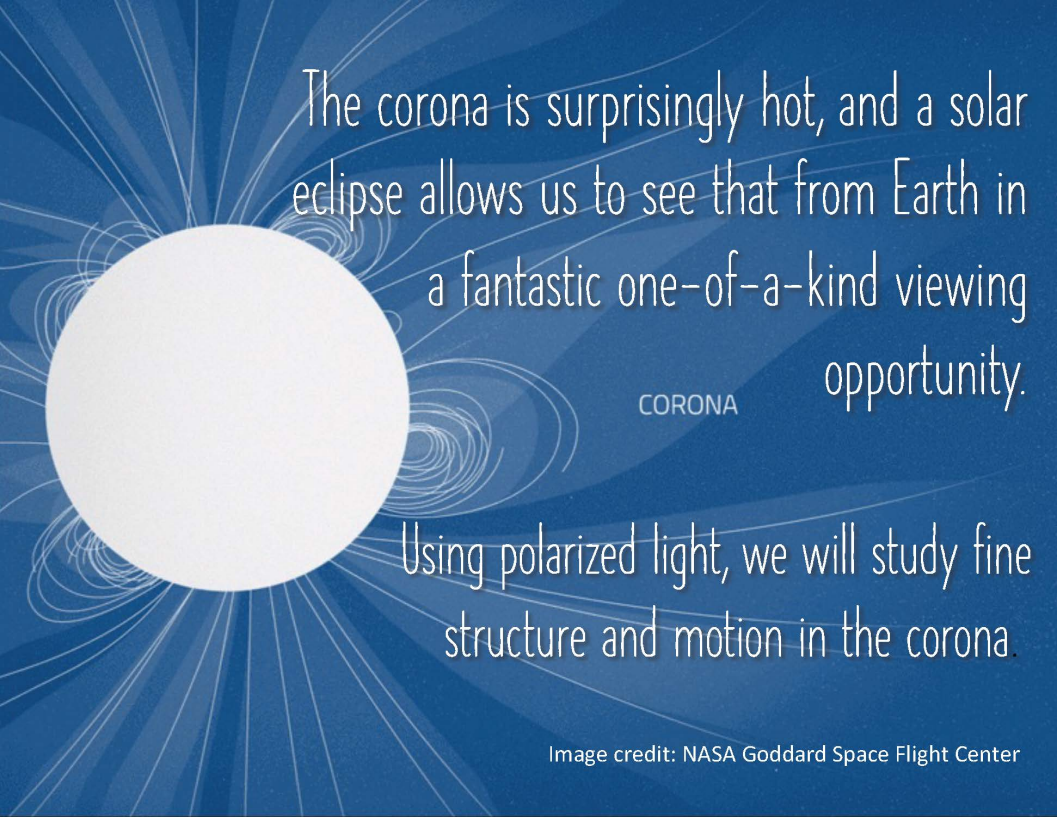
We are seeking volunteers regardless of age or experience.
Interested? Contact us!
cate@boulder.swri.edu

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.
Image credit: NASA Goddard Space Flight Center


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.
NORTH DAKOTA
Ottawa
Montreal
MAINE
NEW BRUNSWICK
Toronto
NEW YORK
NEW HAMPSHIRE
MASSACHUSETTS
CT
RI
New York
PENNSYLVANIA
Philadelphia
NJ
MARYLAND
DE
Washington
WEST VIRGINIA
OHIO
Kansas City
St. Louis
KANSAS
MISSOURI
Indianapolis
Cincinnati
OKLAHOMA
Memphis
TENNESSEE
MISSISSIPPI
ALABAMA
Houston
LOUISIANA
New Orleans
Orlando
Tampa
FLORIDA
Miami
COAHUILA
NUEVO LEON

HamSCI

Ham Radio Science Citizen Investigation

Welcoming
ham radio operators
into the realm of
space physics research

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.

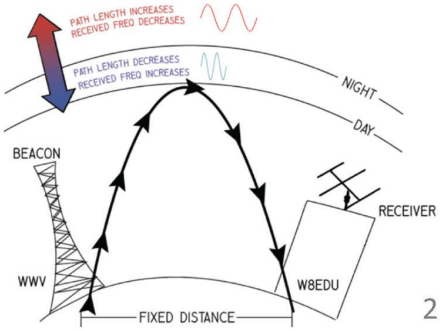
Visit **hamsci.org/eclipse** to learn more!

V 1.0

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.

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.



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.

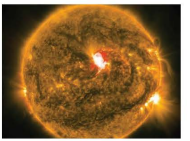
However, hams, long known for building their own gear, are encouraged to assemble *Personal Space Weather Stations (PSWS)*, designed by HamSCI.

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.

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.



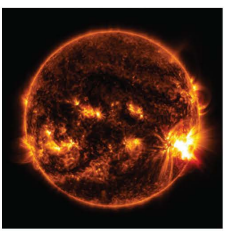
NASA/SDO

Do you want to become a solar radio observer?

Join Radio JOVE:

radiojove.gsfc.nasa.gov

Contact Chuck Higgins:
chiggins@mtsu.edu

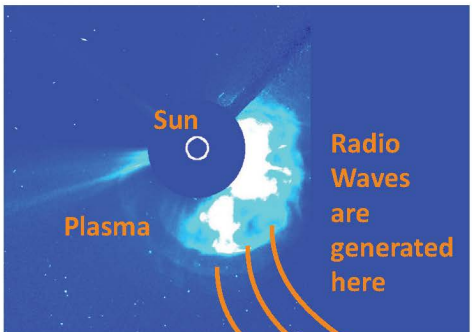


NASA/SDO

Have you heard the Sun?

HELIOPHYSICS BIG YEAR

NASA Partner

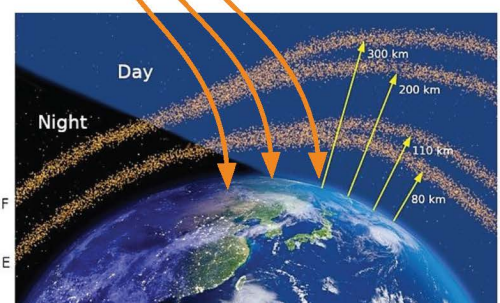


Coronal Mass Ejection (CME) with outgoing shock [NASA/SOHO]

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.

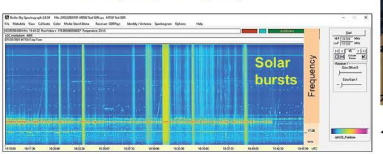


Depiction of the nighttime and daytime ionosphere [C. Molina]

Solar radio waves can be detected using simple radio telescopes.

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

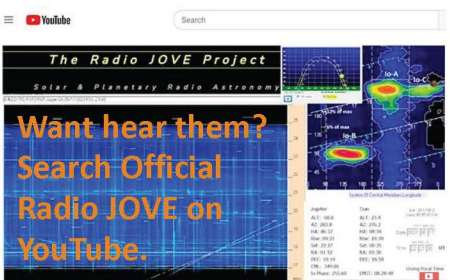
SDRplay*
RSP1A Radio
Receiver



Computer with Radio-Sky Spectrograph Recording Software

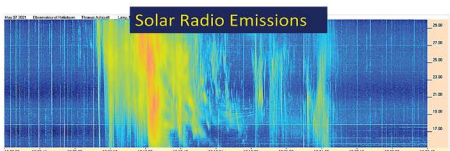
Radio JOVE Dual Dipole antenna, SDRplay RSP1A receiver, and Radio-Sky Spectrograph (RSS) software. [Kit Cost = $220 + shipping + $120 antenna support structure (computer is not included)]. *SDRplay (**www.sdrplay.com**) is a UK-based company that manufactures Software Defined Radio (SDR) radios. Radio-Sky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



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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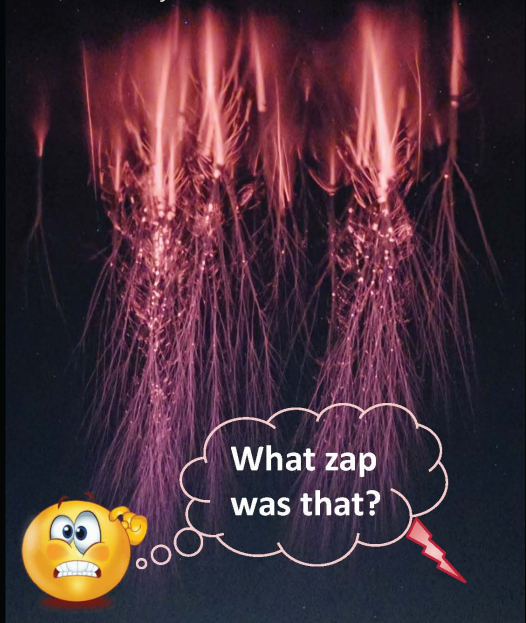
Spritacular

NASA Partner

A Citizen Science Project Studying Electricity Above Thunderstorms

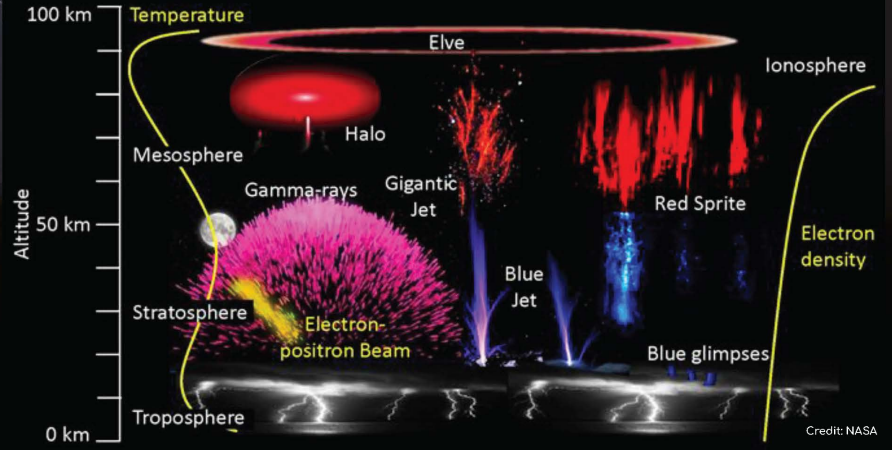


To this day, lightning still remains a mystery, long after Ben Franklin's kite experiment in 1752...

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

Ben Franklin

Transient Luminous Events (TLEs)



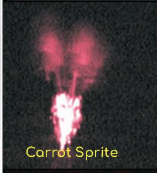
The region of space above the thunderstorms is a zoo of electrical activity! Collectively they are known as Transient Luminous Events (TLEs).

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!

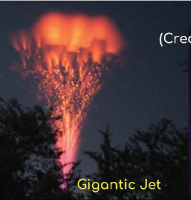

Jellyfish Sprite


Column Sprite

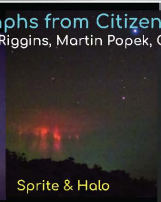

Carrot Sprite

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

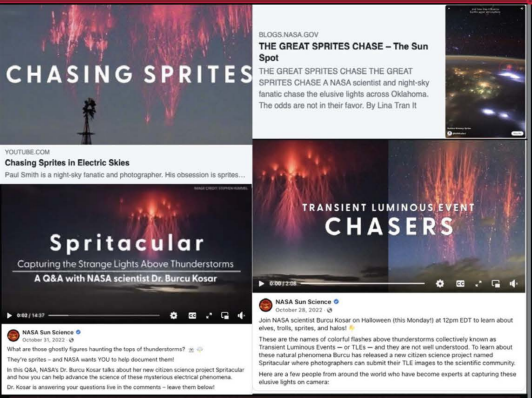

Sprite & Halo

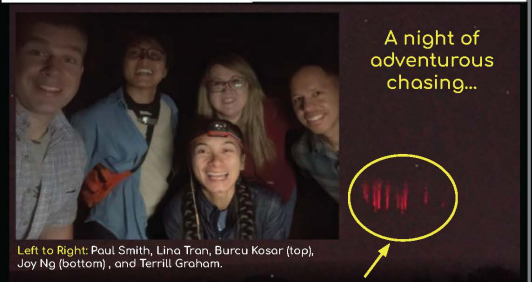

ELVEs


Halo


Angel Sprite

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





You Can Help Advance NASA Science!

Spritacular

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

@spritacular

www:// spritacular.org

NASA Partner

Join the Chase from the ground!

Engage with our community!