



a Harmonious
Outreach
Collaboration

Dr. Becca Robinson – MUSE Outreach Lead
SETI Institute Education Director

“A symphony of Solar Science”

MUSE
MULTISLIT SOLAR EXPLORER

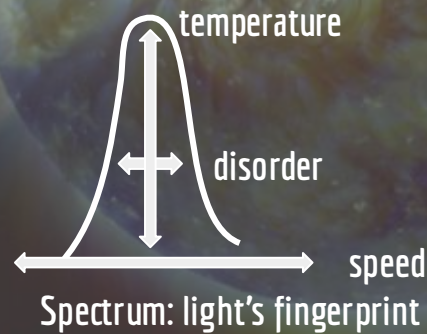
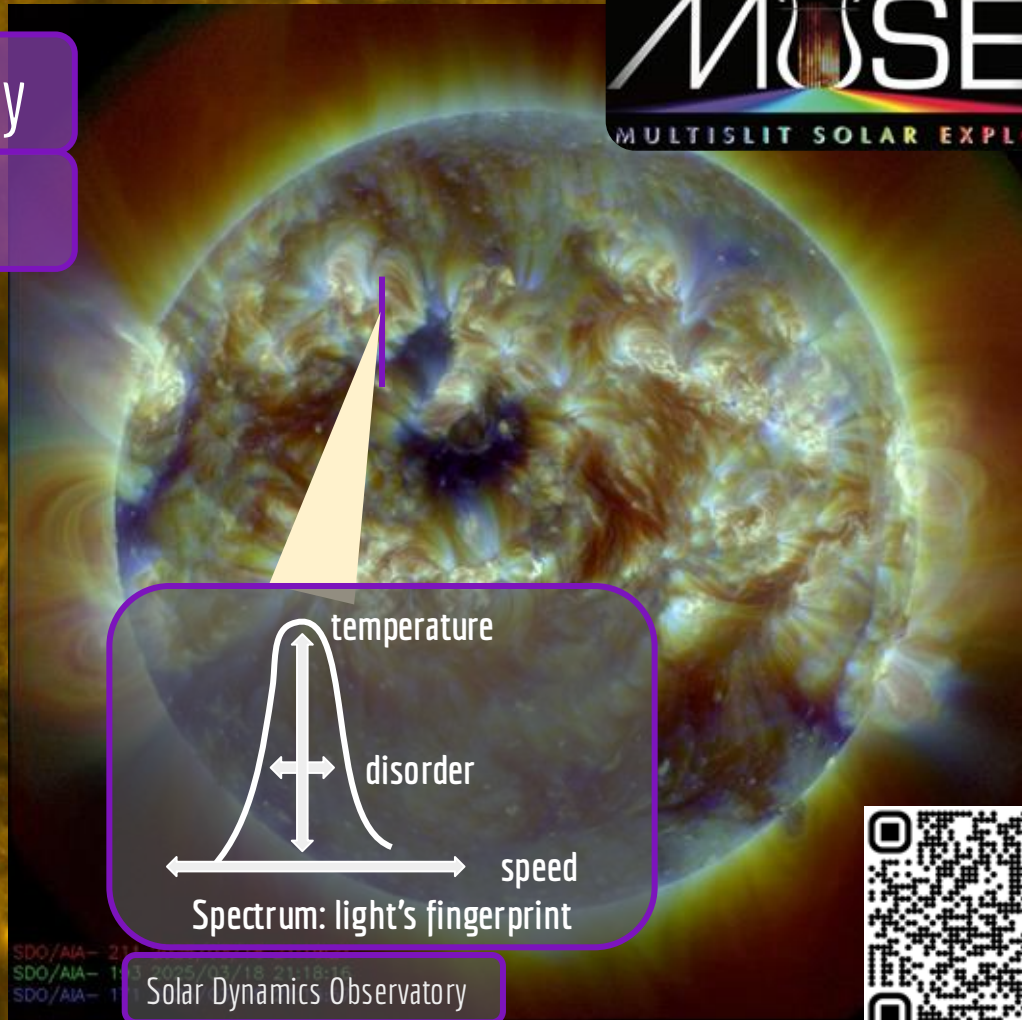
Bart De Pontieu



Extreme Ultraviolet Spectroscopy

(aka: seeing invisible sunlight)

EUV Spectroscopy: splitting extreme UV light into a *spectrum* to figure out temperature, speed, and disorder in the Sun's atmosphere

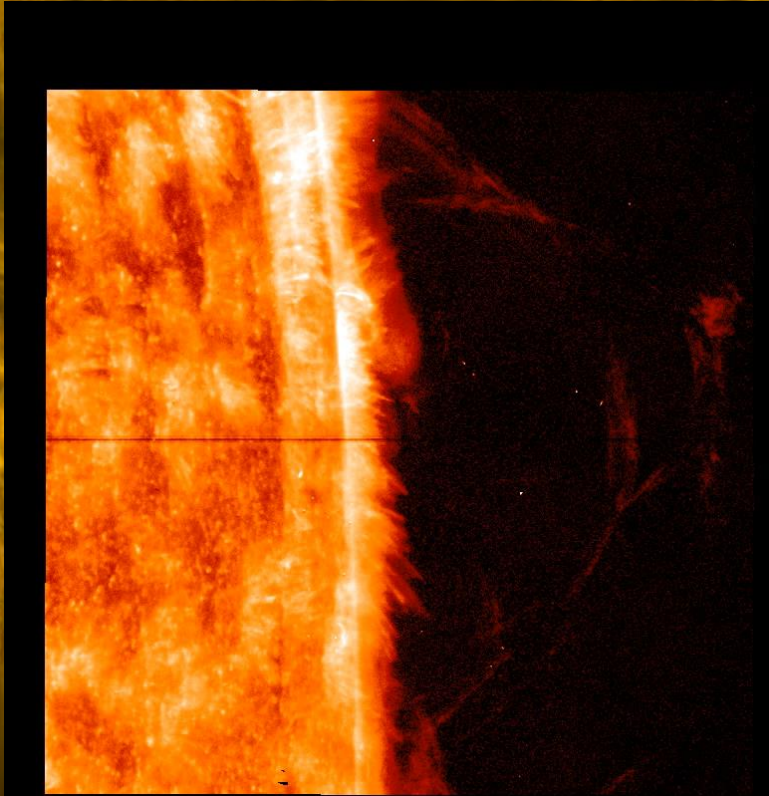


Solar Dynamics Observatory



How do spectrographs work?

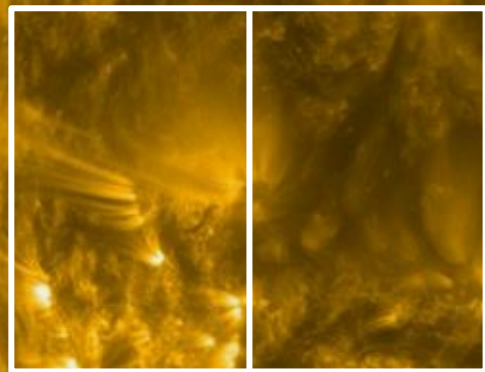
IRIS - Interface Region Imaging Spectrograph



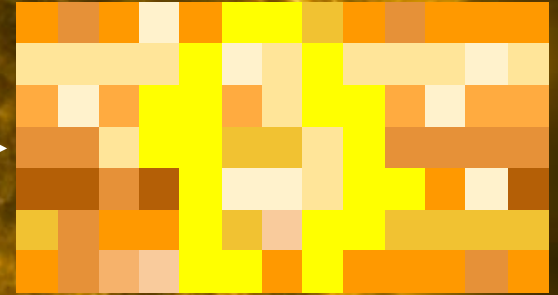
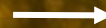
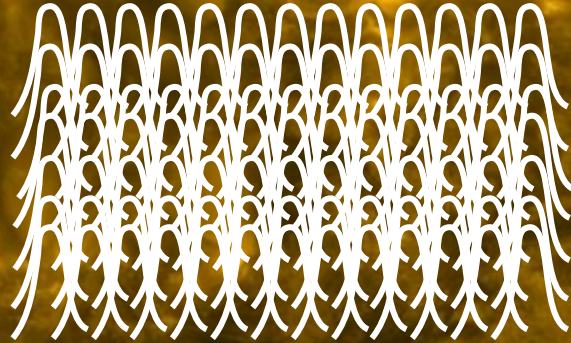
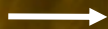
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Single-slit spectrograph



Multi-slit spectrograph



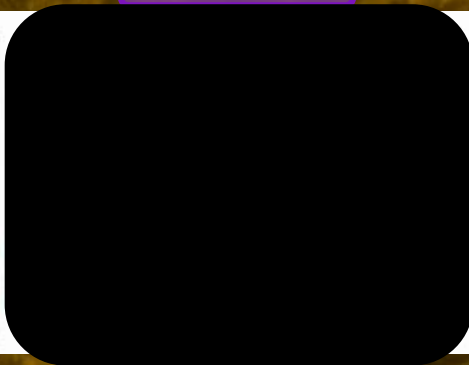
What can MUSE see?



SIMULATION



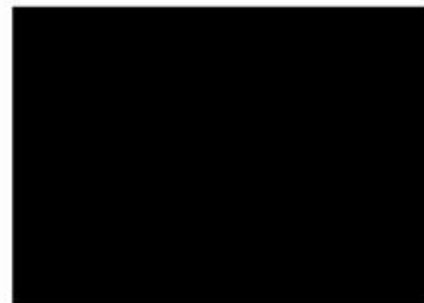
MUSE SYNTH



BEST SINGLE-SLIT



DECENT SINGLE-SLIT



Bart De Pontieu



What can MUSE see?



SIMULATION



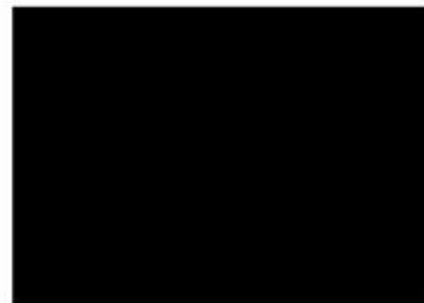
MUSE SYNTH



BEST SINGLE-SLIT



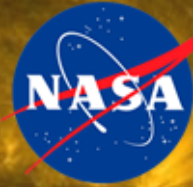
DECENT SINGLE-SLIT



Bart De Pontieu



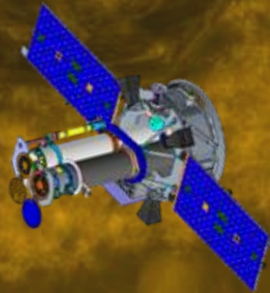
Outreach: Multi-slit Solar Explorer (MUSE)



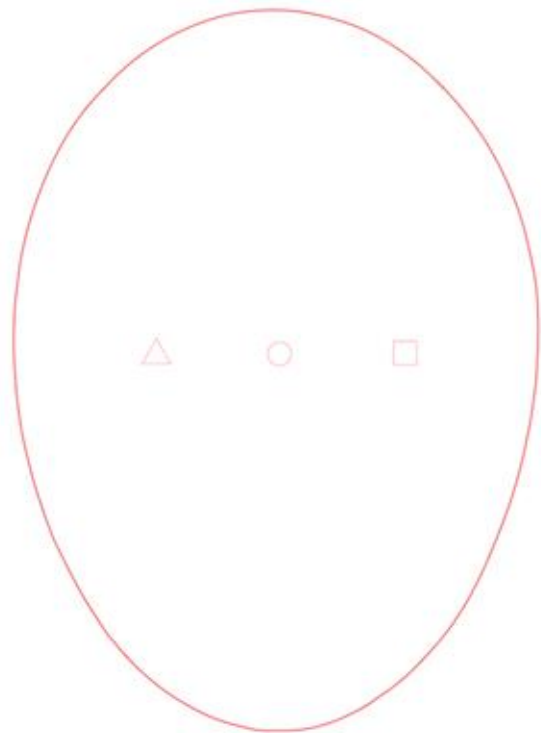
☀️ A new mission to study the Sun! Partnering with:

- ★ Chabot Space & Science Center
- ★ California Academy of Sciences
- ★ Boys & Girls Club of the Peninsula - San Leandro coming soon!

Frontiers EPO
pre-report out now!



Heritage Products from PUNCH: Pinhole Projectors ready to go!



3-Hole PUNCH Pinhole Projector



DO NOT use this card to look directly at the Sun!

1. Facing away from the Sun, hold this card so that the Sun's rays pass directly through the holes onto a smooth surface like a wall or sidewalk (depending on the Sun's height). Move the card closer until you see a triangular, a round, and a square shape of light on the surface.



2. Observe the shapes of light as you slowly move the card farther from the surface. When all three shapes change to round, each hole is forming an image of the round Sun! Making images using only a small hole is called "pinhole projection."



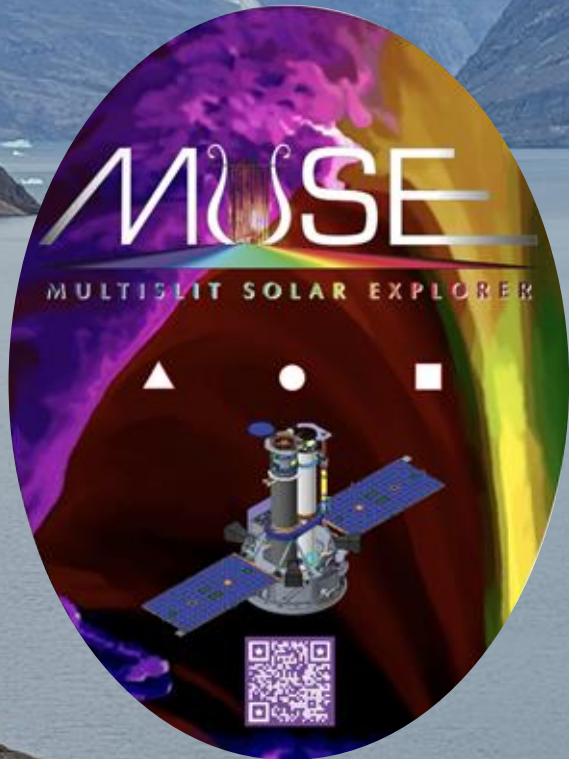
3. During a solar eclipse, repeat steps 1 and 2 to see what happens to the "pinhole images" of the Sun.

4. On every sunny day, small gaps between leaves form images of the Sun. Look for round shapes of light among the shadows of the leaves!

Projector design and instructions
used with permission from NASA
PUNCH Outreach



Coming Soon: Solar Eclipse 2026



Heritage Products from PUNCH: Team Cards (under construction)

BECCA ROBINSON 



MUSE OUTREACH DIRECTOR

MUSE

 **BECCA ROBINSON**
Outreach Director

I rely on creativity and communication skills to convey the relevance and importance of MUSE science as joyfully as possible.

3 skills I need in my job
Creativity, resourcefulness, intuition.

Why MUSE matters
MUSE will grow our understanding of the Sun's dynamic atmosphere and reveal details of magnetic explosions on the Sun. This can help us better forecast space weather events, which impact our lives on Earth.

Sun fun fact
Normal refrigerator magnets are much stronger (~50x!) than the Sun's large magnetic field surrounding it.

What's your wavelength?
Yellow is associated with joy and sunshine; it's my job to convey the joy of understanding our Sun!

What I love about my hobby
Rock Climbing (pictured front)
Problem solving, mental strength, flexibility.

MUSE

OUTREACH

My Name: _____

 If I were a MUSE mission team member, I'd like to be in a role where I: _____

Draw a picture of yourself!

Three words to describe myself: _____

FUN SUN FACT

WORDS THAT HELP GUIDE ME

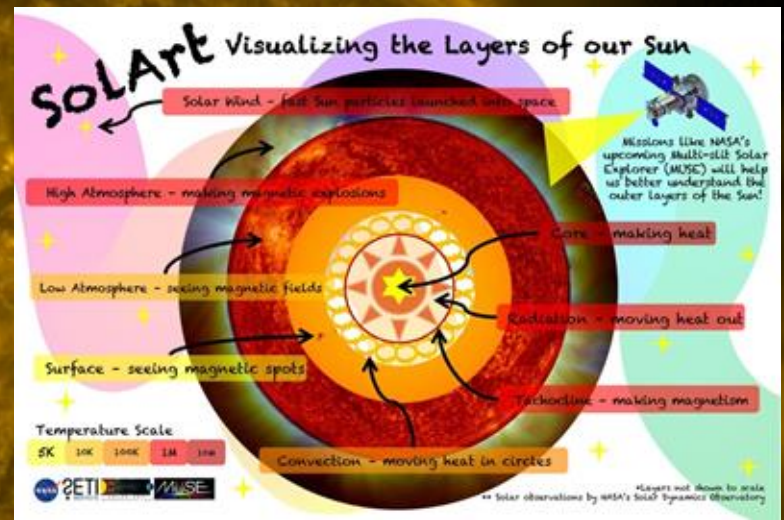
MY WAVELENGTH

MUSE

First Original Product: SolArt



SaM Fontejon/Fontejon Photography, Inc.



Want to learn the science behind SolArt?
Check out our video here!



<https://youtube.com/shorts/j8OPpT-To8M?feature=share>

First Original Product: SolArt



First Original Product: SolArt

SolArt - A Guide for Parents and Educators

Materials

- **Paints:** DecoArt Water Marbling Paint (DecoArt)
- **Thickener:** DecoArt Water Marbling Magic Medium Water prep (DecoArt)
- **Trays:** DecoArt Water Marbling Tray 12"x15" (Blick)
- **Mulberry Paper:** FIVEZERO A4 Mulberry Paper Sheets (Amazon)
- **Drying Paper:** Recollections Cardstock Paper 12"x12" (Michaels)
- **Skewers:** Any ~6" skewer will do, but I have DecoArt Water Marbling Sticks (Blick)
- **SolArt Cards:** original MUSE Outreach design - contact robinson@seti.org for files



East Bay Montessori students enjoying SolArt

Procedure

1. **Day Before:** prepare your **thickened water** according to the instructions on the thickener. I like to use gallon jugs to transport the water.
2. **Setup:** Use 2-3 **trays** per 6' table, pour ~1" **thickened water** into each one.
3. Ask each participant to label a sheet of **drying paper** with their name.
4. Ask each participant to pick two colors of **paint** and drip gentle drops of each color all over the water. Then, have them use their **skewers** to gently swirl the colors together. Say: *"This painting method works from the outside in, so we need to make the environment that our Sun lives in. This swirly paint represents the turbulent, messy plasma that is the solar wind."*
5. Ask each participant to choose one color of **paint** that will represent the outside layers of the Sun. Have them place 1-2 drops of that color right in the middle of the water. Say: *"Now, you'll make the outer atmosphere of your Sun in the middle of the solar wind."*
6. Repeat Step 5 twice more; once to represent the solar surface and once more to represent the solar interior. Explain each layer as participants come to it. Feel free to use **SolArt Cards** to reference each zone.
7. Ask participants to take their **skewer** and make the Sun's "rays" by dragging their **skewer** from their solar interior layer to the solar wind background. Say: *"Now, take your stick and pull the energy out from the inside out, making as many sun rays as you'd like all around your Sun."*
8. When the participants are satisfied with their Sun, gently place the **mulberry paper** on top of their design. Place the participant's **drying paper** between you and the tray. Then, grab the two nearest corners of the **mulberry paper** and gently drag it out of the water, carefully setting it onto the **drying paper**.
9. Set the art aside for at least 30 minutes to dry.
10. Distribute the **SolArt Cards** for more information on the Sun's layers and NASA's MUSE mission



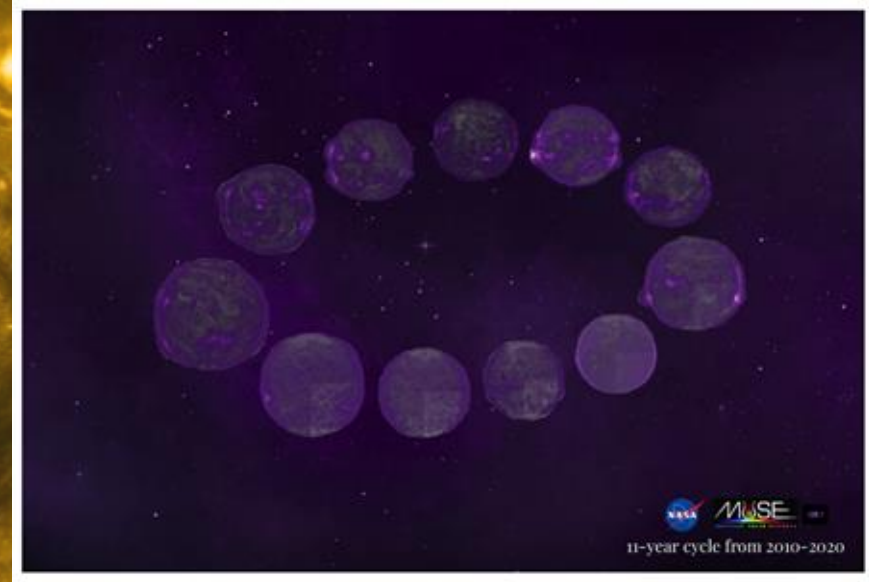
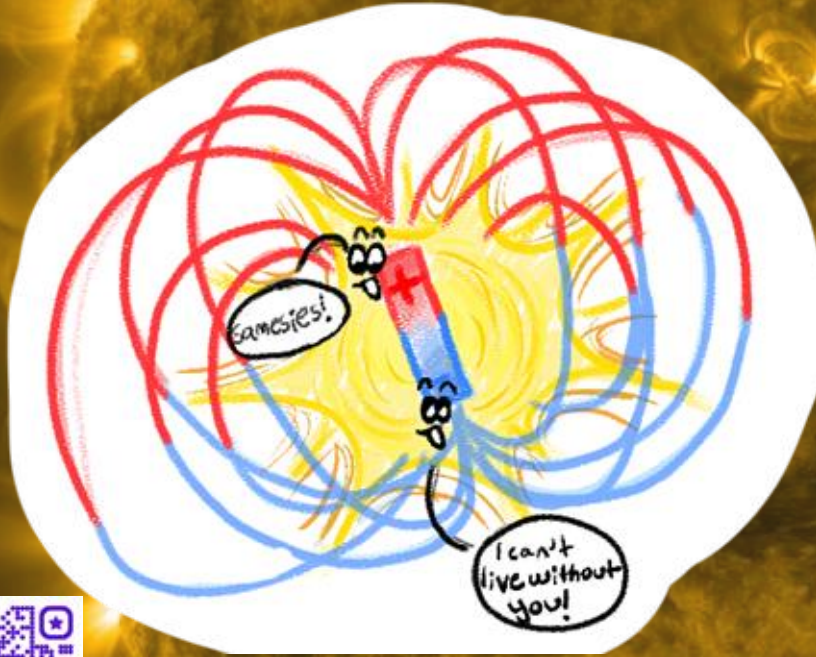
Boys & Girls Club Internship



Boys & Girls Club Internship



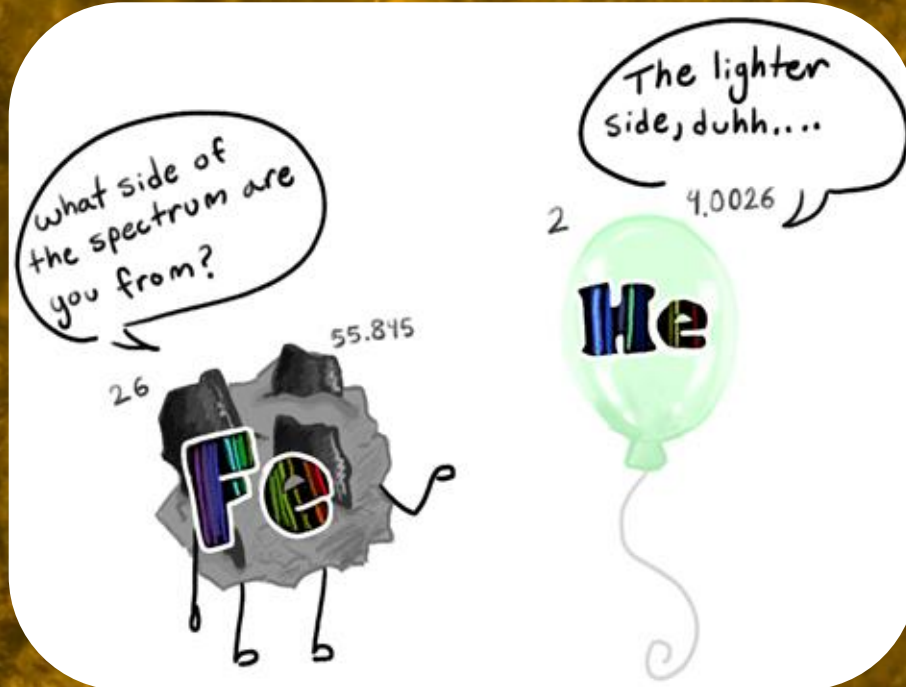
MUSE Outreach Themes: Magnetic Fields



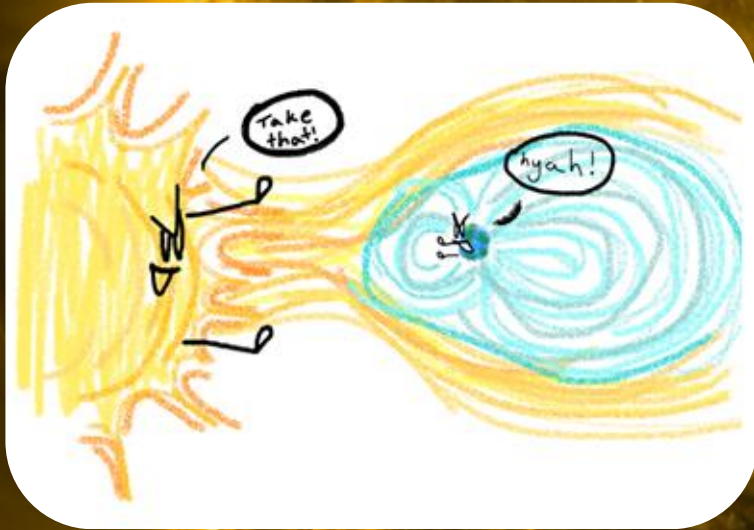
Angel K - Boys & Girls Club Intern 2025

Danny P - Boys & Girls Club Intern 2025

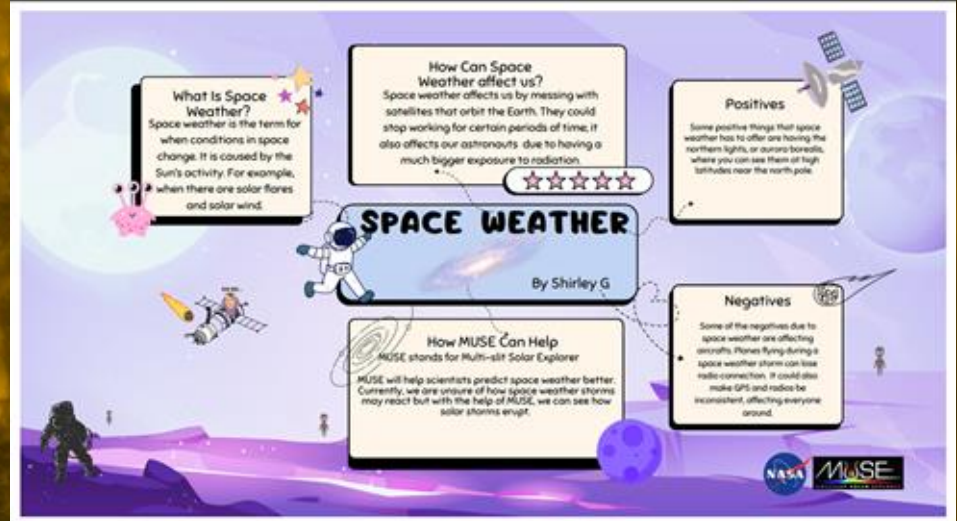
MUSE Outreach Themes: Spectroscopy



MUSE Outreach Themes: Space Weather



Angel K - Boys & Girls Club Intern 2025



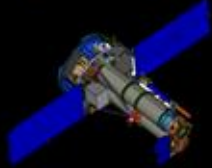
Shirley G - Boys & Girls Club Intern 2025



MUSE Outreach Themes: Space Weather



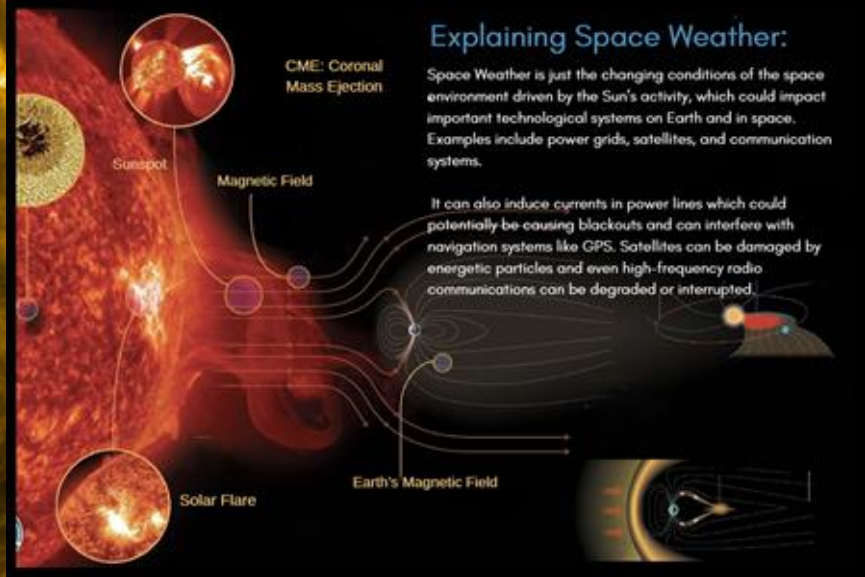
Explaining Space Weather:



Space Weather does not just affect systems on Earth - it can also affect spacecrafts. The increased radiation can in fact damage components on the spacecraft. Space weather can also affect the astronauts due to the radiation from solar storms. This can be dangerous for the astronauts in space, especially during the long duration missions.

The reason space weather affects satellites is because of the high-energy particles which damage the satellite electronics. This can cause malfunctions, or lead to the equipment failing. For example, geomagnetic storms can alter the orbit of a satellite, which could make tracking and coordination more difficult.

Credit: Cheung, Rempel et al. 2019



Explaining Space Weather:

Space Weather is just the changing conditions of the space environment driven by the Sun's activity, which could impact important technological systems on Earth and in space. Examples include power grids, satellites, and communication systems.

It can also induce currents in power lines which could potentially be causing blackouts and can interfere with navigation systems like GPS. Satellites can be damaged by energetic particles and even high-frequency radio communications can be degraded or interrupted.



Elvis D - Boys & Girls Club Intern 2025

Second Original Product: MUSE Board Game



MUSE Board Game @ Death Valley Dark Sky Fest



MUSE Board Game feat. PUNCH!

Did you know?

NASA's MUSE mission isn't the only NASA satellite studying the Sun! Here are a few other missions in NASA's Heliophysics fleet:



NASA's Interface Region Imaging Spectrograph (IRIS) observes the dynamic Chromosphere



NASA's Solar Dynamics Observatory (SDO) observes the entire Sun from Photosphere to Corona



NASA's Parker Solar Probe (PSP) is in orbit around the Sun, flying through the Solar Wind to give us direct observations



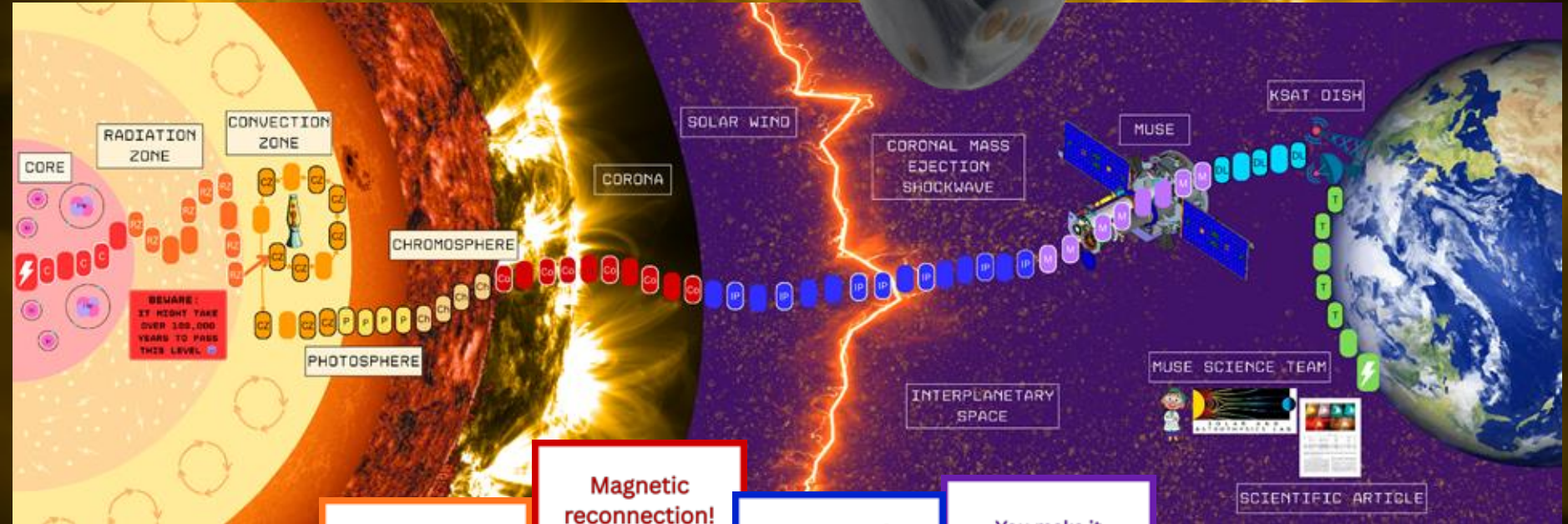
NASA's Polarimeter to UNify the Corona and Heliosphere uses four suitcase-sized spacecraft to study the details of the Solar Wind



ESA/NASA's Solar Orbiter is orbiting the Sun and is the first spacecraft to look at the Sun's poles



You're invited to play!



You collide with another particle and get a boost! Advance 2 steps.

Magnetic reconnection! Bring the closest player to your position.

You get stuck on a huge magnetic loop! Go back to the last Corona "Co."

You make it through the slit mask and diffraction grating! Advance 1 step.



MUSE

MULTISLIT SOLAR EXPLORER