

# Solar Maximum Observing Challenge

September 11, 2024

This webinar will begin at 1:00 pm Mountain Time and  
will be recorded

# Facilitators

Claire Ratcliffe Adams

Education Associate

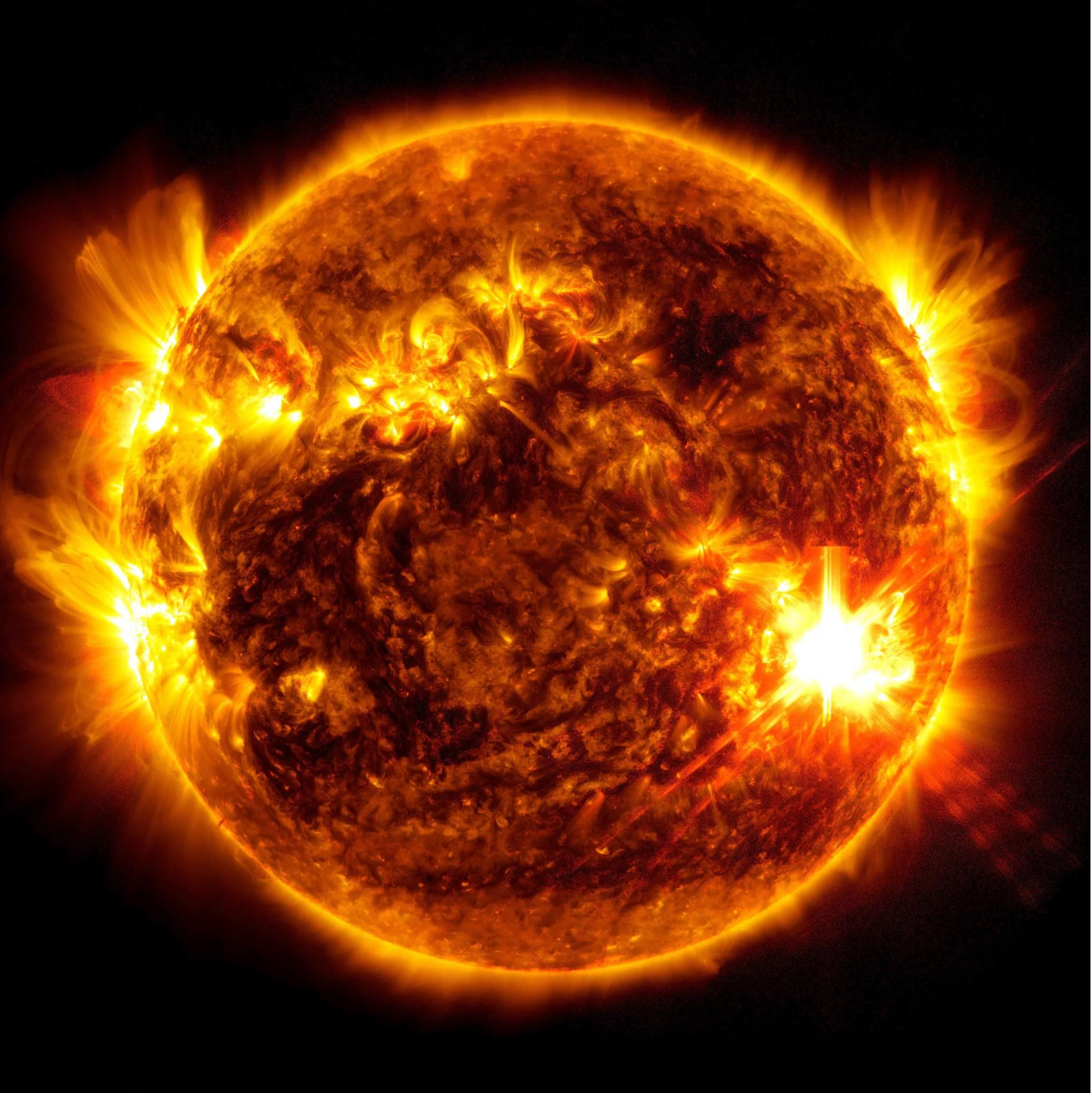
Space Science Institute

[cratcliffe@spacescience.org](mailto:cratcliffe@spacescience.org)

Aaron Clevenson

Astronomical League

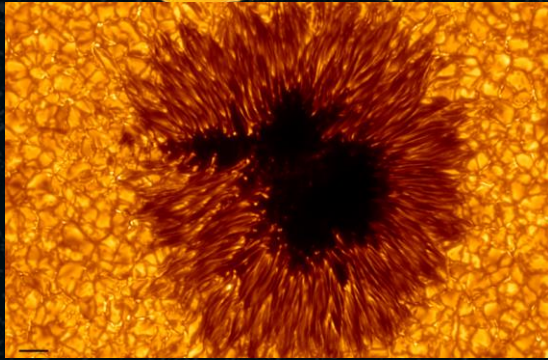
[Aaron@clevenson.org](mailto:Aaron@clevenson.org)



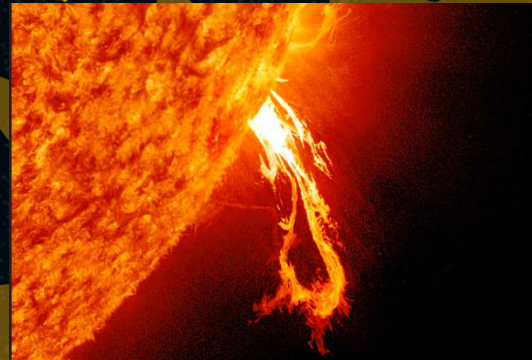
# Agenda

- Introduction/Icebreaker
- Overview of Astronomical League and Solar Maximum Observing Challenge
- Demonstration: Soda Bottle Magnetometer
- Discussion: Incorporating the Observing Challenge in Library Programs
- Additional FREE Astronomy Resources
- Q&A

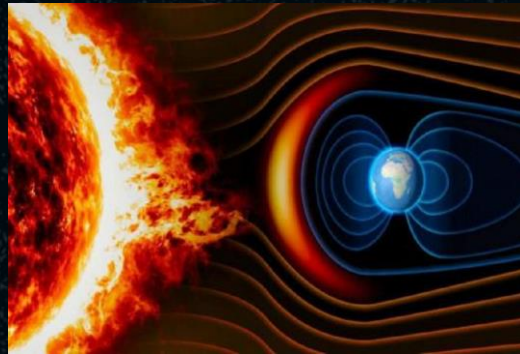
# Icebreaker: What solar feature do you feel like today?



1. Sunspot: (relatively) cool, calm, and collected; embracing change and transition



2. Solar Prominence: showy and bright, while also feeling grounded and connected



3. Coronal Mass Ejection: powerful and influential; ready to mess things up!



4. Sun's Corona: Gassy and Sassy. You won't let anybody's shadow dim your light.

# Solar Maximum Observing Challenge

Aaron Clevenson  
Astronomical League  
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September 11, 2024



Astronomical League



# Who am I?

- Observing Program Director with the Astronomical League
- Director of the Insperity Observatory in Humble, TX
- Retired Astronomy Professor at Lone Star College
- Member of the North Houston Astronomy Club
- Retired Computer Engineer



# The Astronomical League

- International Organization of over 23,000 amateur and professional astronomers
- Promoting observing and astronomical learning
- Over 65 Observing Programs developed for members
- But also...
- Observing Challenges available to EVERYONE, even non-members!



# Observing Challenges?

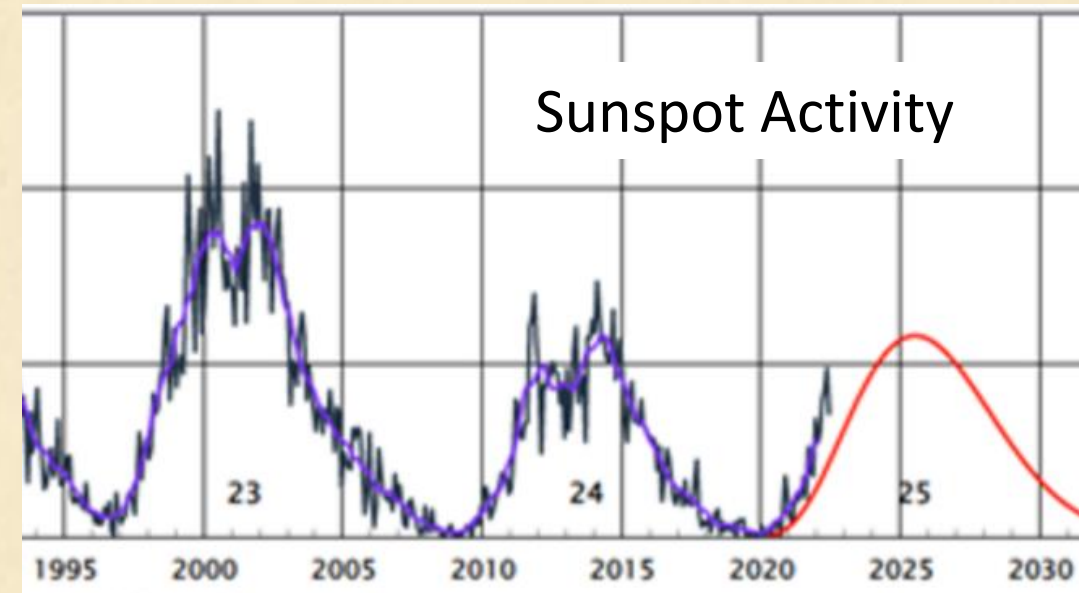
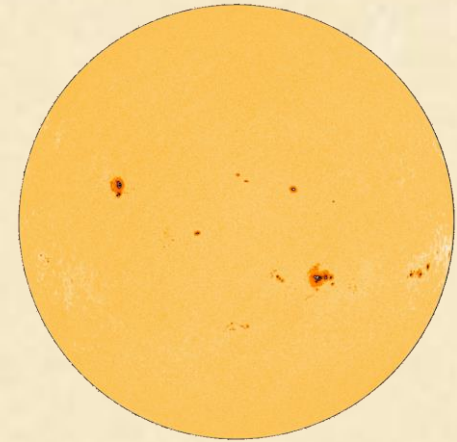
- Two Types:
  - Astronomical League Observing Challenges – focus on Celestial Objects
  - NASA observing Challenges – focus on NASA Missions
- Focus on the first type: Solar Max Observing Challenge
- Purpose:
  - To observe the effects of the Solar Wind
  - Using a homemade Magnetometer





# First a Bit About the Sun

- The Sun is a typical star, not too big, but not too small either
- Every 11 years, the Sun goes through a Max/Min Cycle
- During each cycle there is a Maximum:
  - More magnetic activity on the Sun
  - More Sunspots
  - More Solar Wind
  - More Coronal Mass Ejections





# A Bit More About the Sun

- Light travels very fast, but it is not instantaneous
- Light gets to Earth from the Sun in 8 minutes and 20 seconds
- The Sun emits charged particles
- There are more during solar maximums, especially when there are large coronal mass ejections
- Charged particles travel slower than light
- They reach Earth in 55.5 to 166 hours (2.3 to 6.9 days)
- They are trapped by the Earth's magnetic field
- Causing the Aurora Borealis and Aurora Australis
- And also cause changes in the Earth's magnetic field



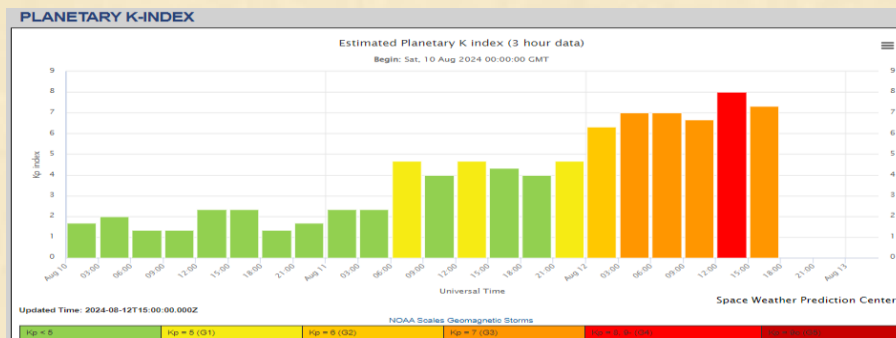
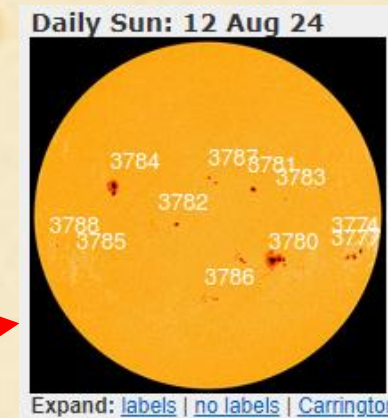
# The Observing Challenge

- <https://www.astroleague.org/al-observing-challenge-special-observing-award/>
- Build a homemade Magnetometer
- Place it somewhere where it will not be disturbed. It should be on a hard solid surface
- Make 50 Observations with your Magnetometer
  - Up to two per day
  - Start at any time
  - End by March 31, 2025
- **Submit your Observations to the Astronomical League Coordinator by April 30, 2025. A Certificate is emailed to you upon completion.**



# What is an Observation?

- Note where the spot is along the yard stick.
- Check the website: [www.spaceweather.com](http://www.spaceweather.com)
- Get the Current Image of the Sun
- Get the current Image of the Aurora Projection
- Get the Planetary K-Index Chart



- Predict when the next major event will happen on Earth



# A Sample Observation

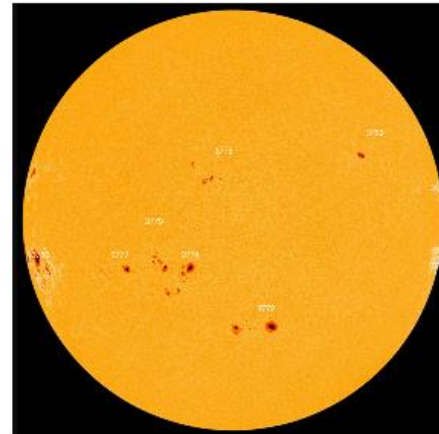
## What to Record:

- Date
- Time
- Magnetometer Reading
- Solar Image
- Aurora Forecast
- Planetary K-Index Chart

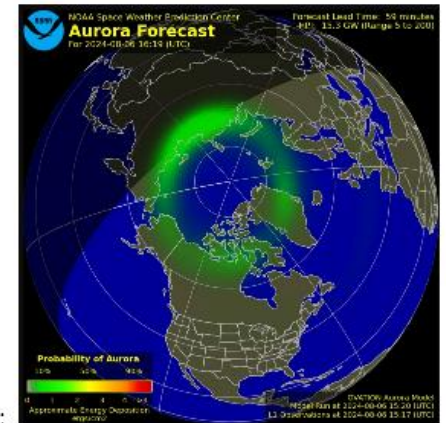
Observation #9:

8/6/2024 1018

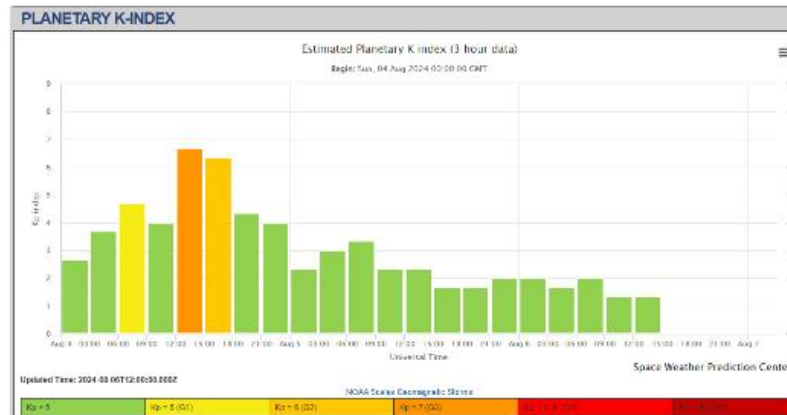
Measurement: 13



Sunspot Activity:

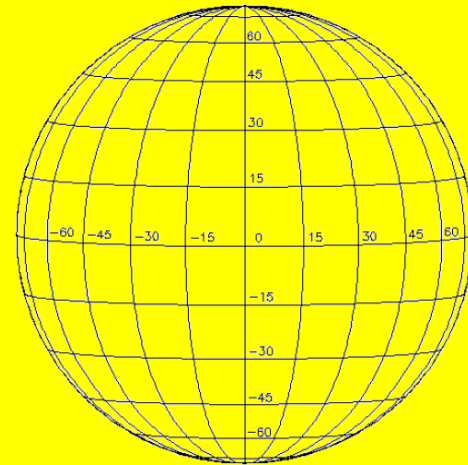


Auroral Forecast:



Planetary K-Index:

A major sunspot group entered the Sun on 8/1/2024.





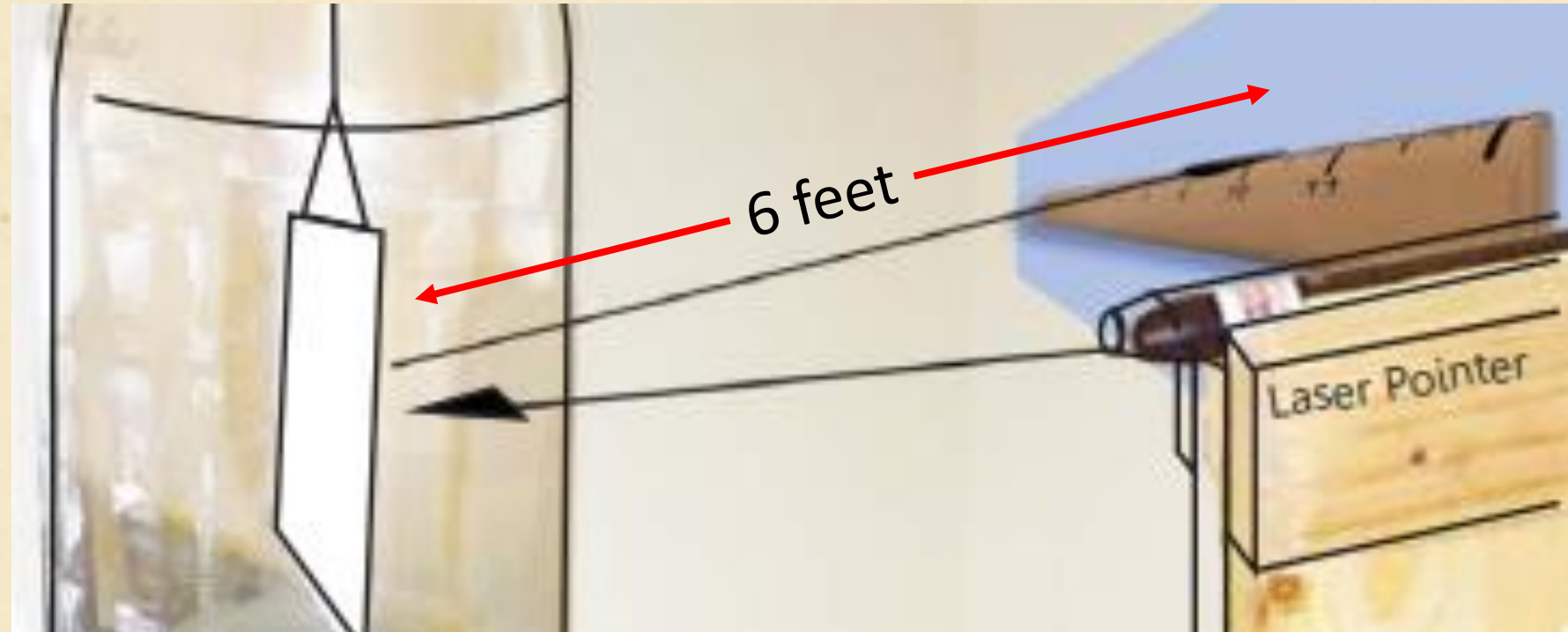
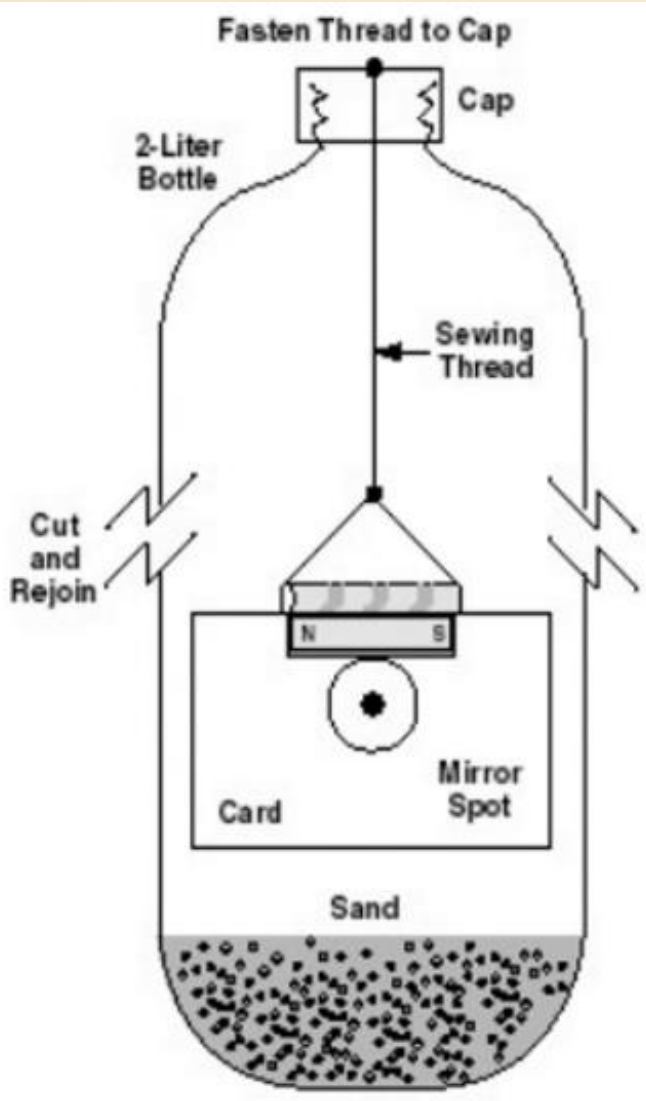
# Materials Needed

- Empty 2-litre Soda Bottle
- Sand or Small Pebbles
- Small Lightweight Mirror
- Small Bar Magnet
- Drinking Straw
- Thread
- Index Card
- Yard Stick or Meter Stick
- Flat White Target
- Light Source: Red Laser or a Bright Light



# The Magnetometer

Claire will walk us through the process...

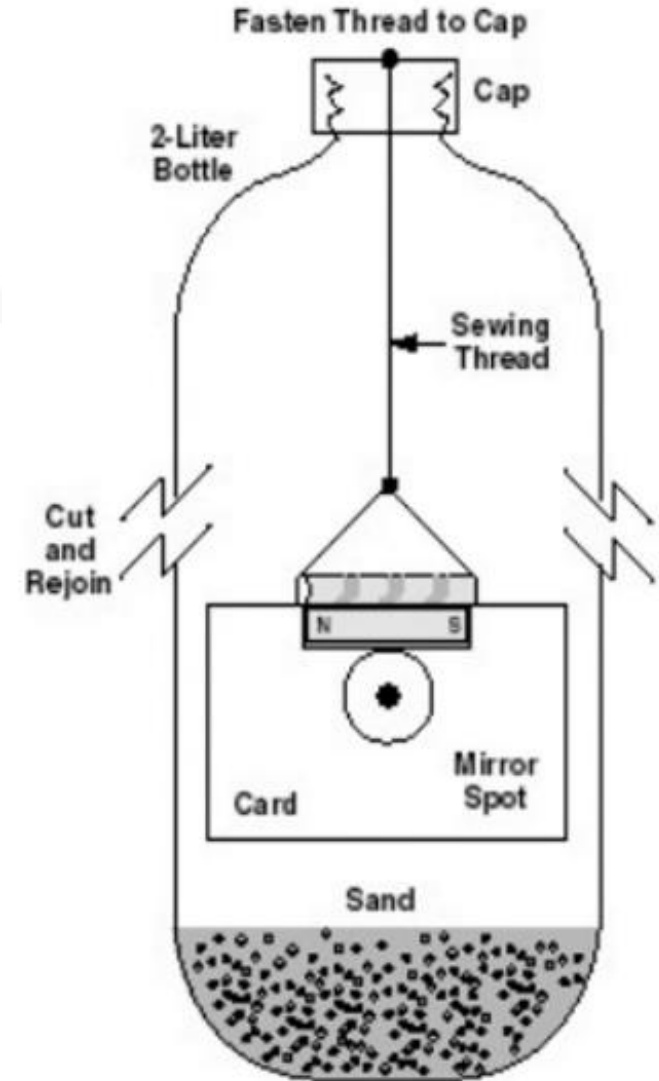




# Build a Soda Bottle Magnetometer

## Materials

- A clear plastic 2-liter soda bottle with lid (label removed)
- Sewing thread
- Bar magnet shorter than width of the bottle
- Small craft mirror or sequin
- 3x5 index card
- Sand or rice (to stop the bottle from falling over)
- Reusable adhesive (like Blu-Tack) as needed for balance
- Drinking straw OR copper wire
- Tape, scissors, and super glue





1. Cut off the top or bottom  $\frac{1}{3}$  of the bottle (use marker to draw circle prior to cutting)

2. Fill the bottom  $\frac{1}{3}$  with sand or rice.

3. Prepare to hang the bar magnet.

**Drinking Straw**



OR

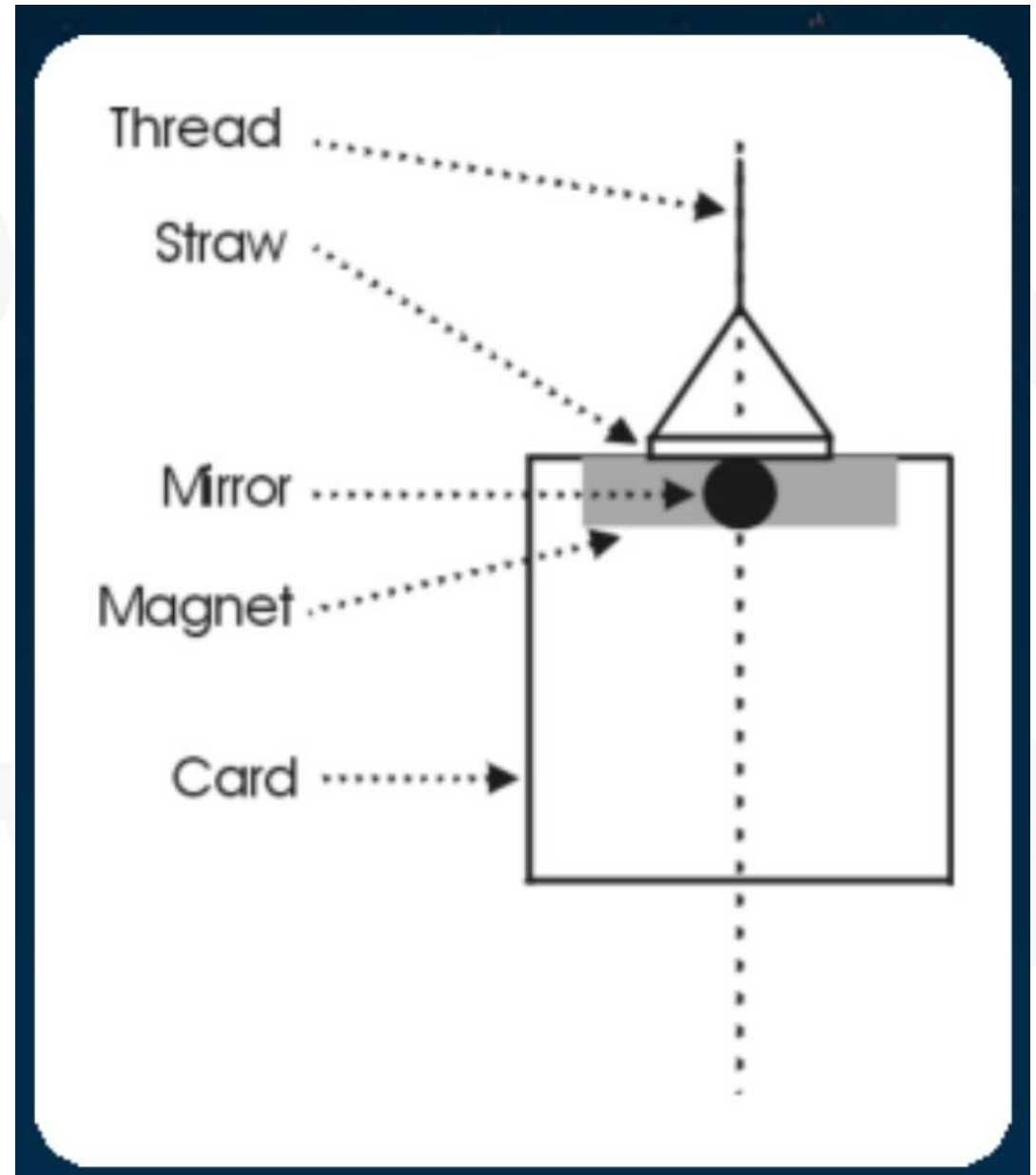
**Copper Wire**

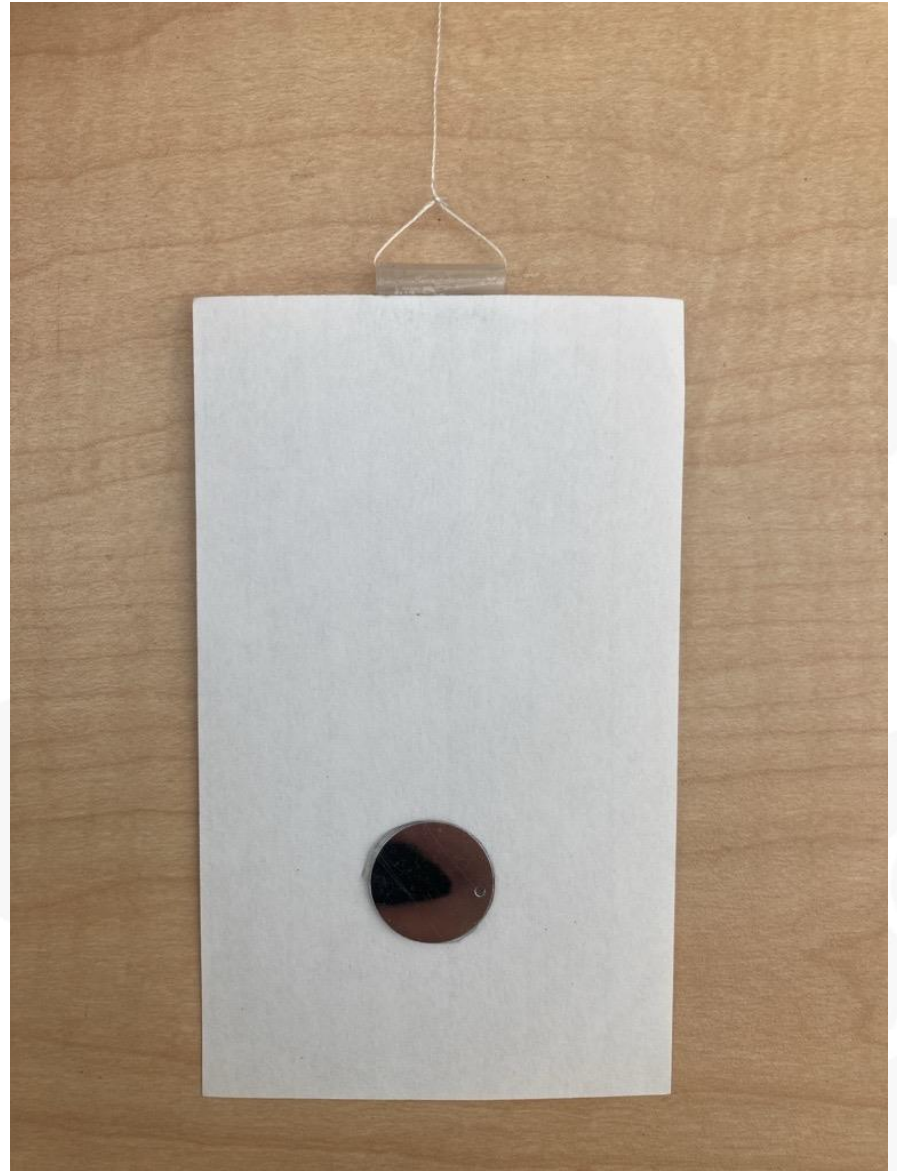
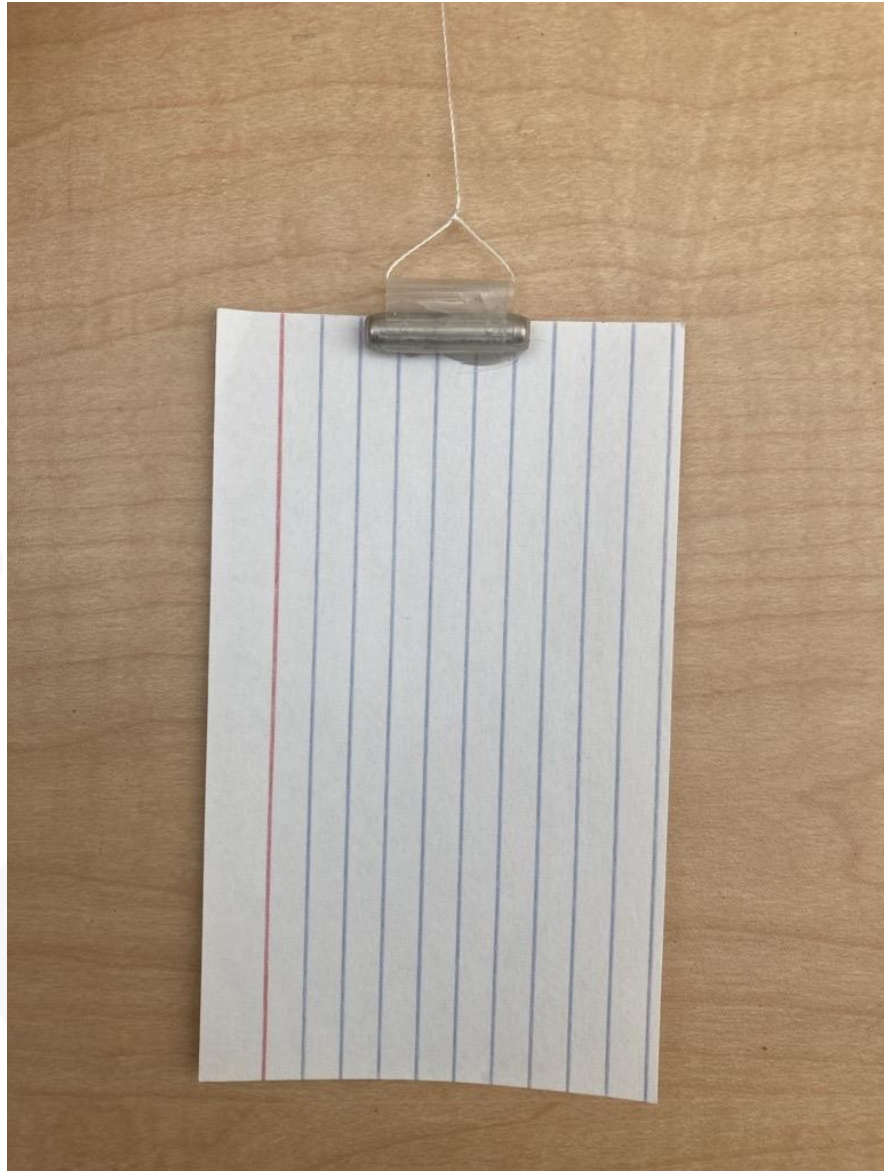


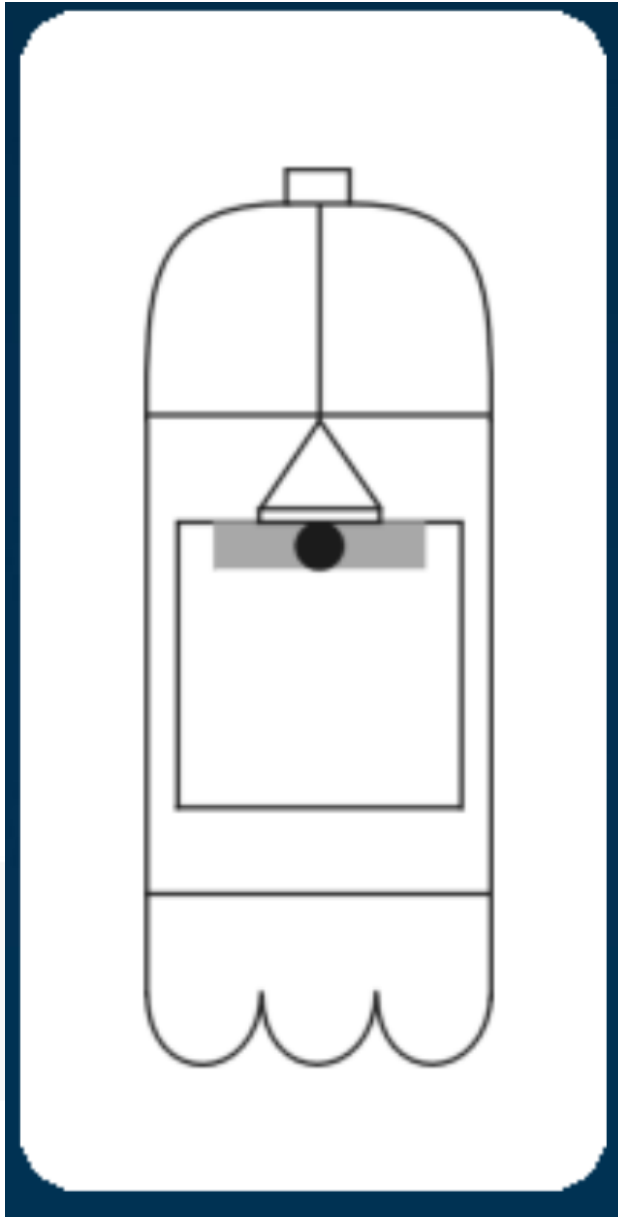
4. Glue the magnet to the top edge of the index card.

5. Attach sequin/mirror to the middle of the other side of the magnet.

6. Magnet **MUST** hang horizontally (use small piece of blu-tack to rebalance if necessary).



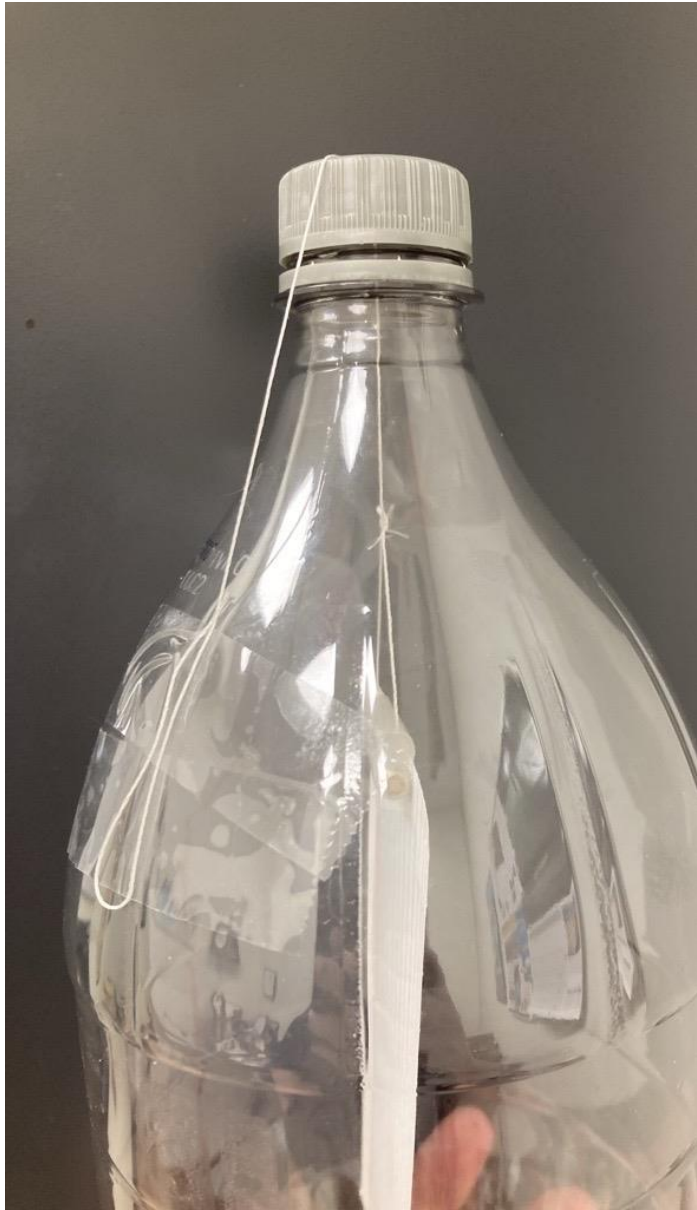
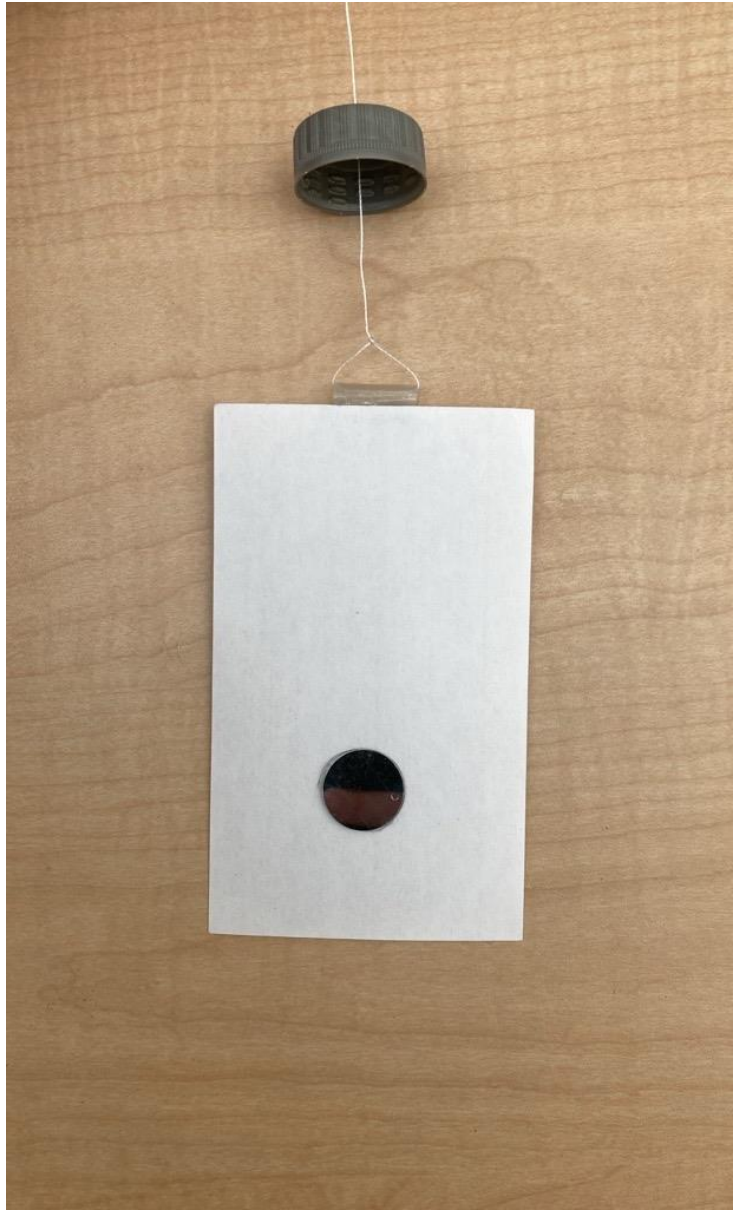




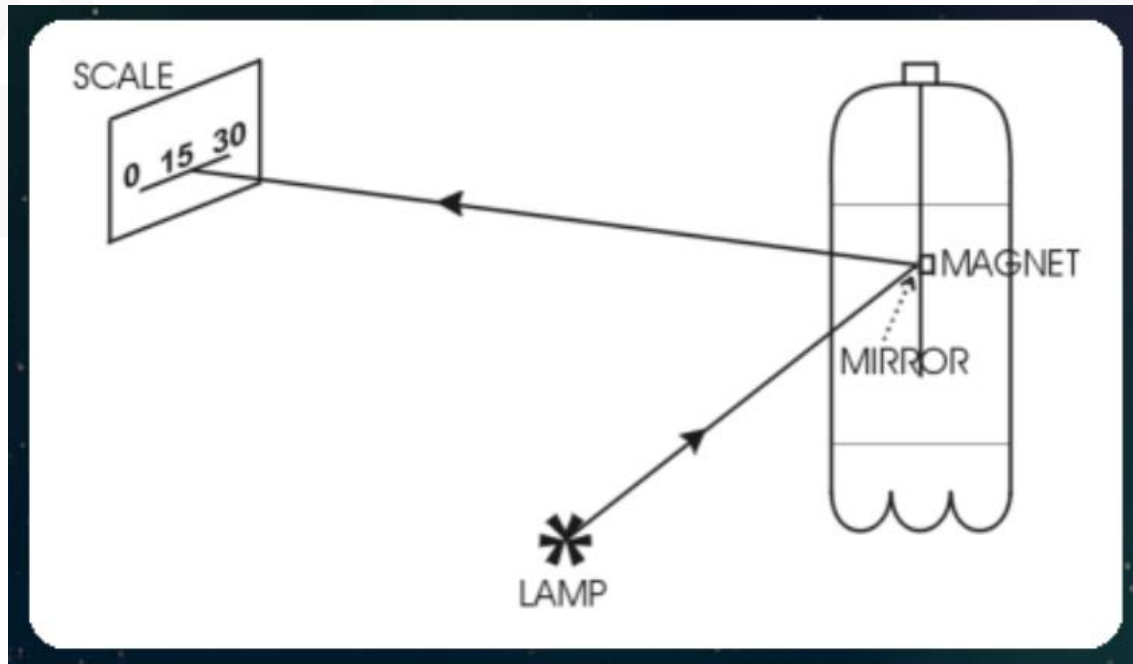
7. Make small hole in the center of the bottle cap and screw back on.

8. Feed thread & mirror/sequin through the hole and secure it to the bottle top.

9. Tape the top of the bottle to the bottom.



# Taking Measurements







US Solar Eclipses: 8/21/17, 10/14/23 (annular), 4/8/24

US Total Lun



Discussion:  
How to  
incorporate the  
Solar Maximum  
Observing  
Challenge in  
Library  
Programs



Promote the challenge and share info with your community



Build magnetometers in a program for participants to take home

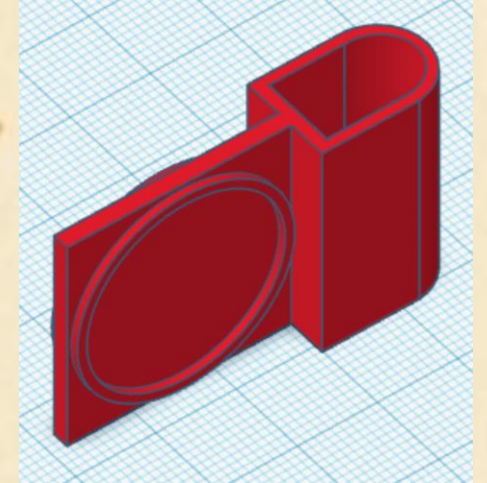


Collect data with STEM programs/Teen Advisory Boards (daily is ideal for the challenge)



# Additional Resources

- Mirror Holder STL file for 3D Printer
  - Contact Aaron Clevenson at [aaron@clevenson.org](mailto:aaron@clevenson.org) and I will send it to you



- Mirrors: Something like these:
  - [https://www.amazon.com/dp/B08XMXXVMP?ref=ppx\\_yo2ov\\_dt\\_b\\_fed\\_asin\\_title](https://www.amazon.com/dp/B08XMXXVMP?ref=ppx_yo2ov_dt_b_fed_asin_title)

- Magnets: Something like these:
  - [https://www.amazon.com/dp/B01MT1PF1P?ref=ppx\\_yo2ov\\_dt\\_b\\_fed\\_asin\\_title](https://www.amazon.com/dp/B01MT1PF1P?ref=ppx_yo2ov_dt_b_fed_asin_title)





# Two More Free Opportunities

- Sky Puppy Observing Program

- Youth 10 and Under
- Working with Parents or a Group with a Leader
- Free Workbook or Manual
- Certificate and Pin
- Contact Aaron Clevenson at

[aaron@clevenson.org](mailto:aaron@clevenson.org)

- Astronomy For Mere Mortals Textbook

- Intro Level High School or Community College
- Complete textbook (500 plus pages)
- Free Electronically, Downloadable from the Astronomical League:  
<https://www.astroleague.org/wp-content/uploads/2024/08/Astronomy-For-Mere-Mortals-v-20240806.pdf>

Q&A

