STARS RESOURCES

Teacher notes

Solar observing

ACTIVITY

To make observations of the Sun and gain an appreciation for its main features, including prominences and sun spots.

By the end of this activity students may:

- Be able to name common features of our nearest star, the Sun
- Be comfortable collecting observational data using a telescope (optional)
- Recognise trends in data and use these to make predictions of future behaviour
- Have basic skills to practice safe procedures when observing an object that poses huge danger (optional).

SAFETY INFORMATION

***First of all, READ the accompanying safety document. Observing the Sun incorrectly is extremely dangerous, and causes irreversible damage to the eyes. If you have any concerns about using a telescope and solar filters, then don't. There are alternative options within the document using images from space telescopes. ***

ACTIVITY

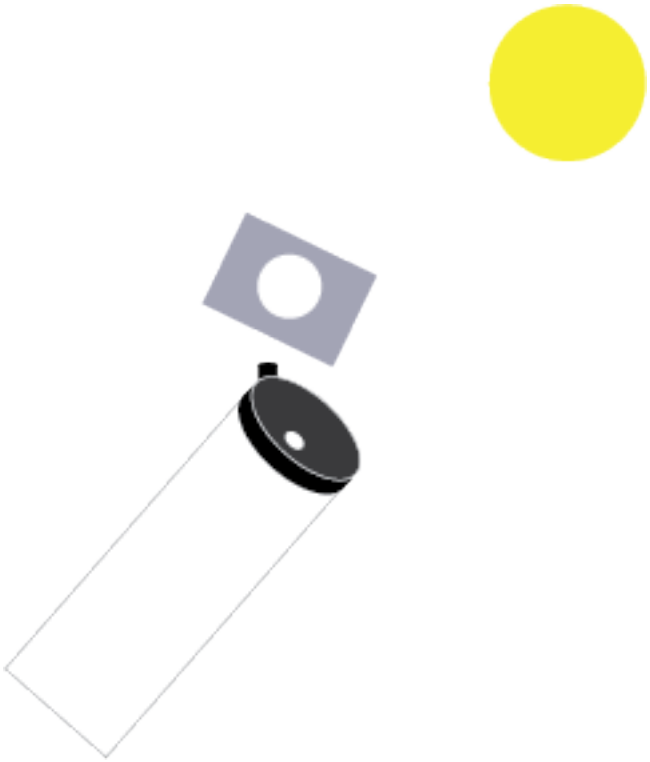
Alternatives in order of decreasing safety concerns:

1. If you do wish to use your reflecting telescope (e.g. Dobsonian), follow these instructions:

- Set up a piece of white paper, or large white card, at about the same height as the eyepiece of the telescope, when it's angled at the Sun. Have the paper hanging vertically.
- DO NOT LOOK DOWN THE MIRROR. In order to focus the projection of the Sun, move the paper closer or further away from the eyepiece.

2. If you have a refracting telescope (i.e. not a reflecting telescope), try making a sun funnel. Follow these instructions from NASA to create a rear projection of the Sun using easy-to-find materials from hardware stores, and your telescope eyepiece.
https://eclipse2017.nasa.gov/static/img/make-sun-funnel/Build_a_Sun_Funnel_v4.pdf

ACTIVITY cont'd



3. Use National Geographic's alternative suggestions, including using binoculars and white posterboard. https://www.nationalgeographic.org/activity/build-a-sunspot-viewer/

4. Simply skip using a telescope and have the students use live data from the space telescopes SDO, STEREO or SOHO to count sunspots and observe prominences and flares.

The following web pages all have options for downloading up-to-date images of the Sun.

- 'The Very Latest SOHO Images', ESA and NASA, https://soho.nascom.nasa.gov/data/realtime-images.html
- 'SDO - The Sun Now', NASA Solar Dynamics Observatory, https://www.nasa.gov/mission_pages/sdo/the-sun-now/index.html
- 'SDO | Data', NASA, https://sdo.gsfc.nasa.gov/data/
- 'STEREO daily browse images and plots', NASA | Solar Terrestial Relations Observatory, https://stereo.gsfc.nasa.gov/browse/2022/02/16/

Teacher notes
Solar observing

BACKGROUND INFORMATION

Here is a video showing how to observe the Sun by projecting its light onto a piece of cardboard, '2017 Eclipse Viewing Using Telescope Projection Method and howto - Sun Spots too!', EVERYTHING cpo YouTube (6:15 mins) https://youtu.be/ehi-vsRb4Ao 22 Aug 2017

Read more detail about the Sun and its solar cycle on 'Solar Cycle Science' website written by two solar astronomers, SolarCycleScience.com, http://solarcyclescience.com/index.html 2017

Read more about hydrogen and helium fusion on Forbes.com, 'The Sun's energy doesn't come from Fusing hydrogen into helium (mostly)', Forbes, https://www.forbes.com/sites/startswithabang/2017/09/05/the-suns-energy-doesnt-come-from-fusing-hydrogen-into-helium-mostly/ 5 Sept 2017

To learn more about the features on the Sun, read this webpage from the Astronomical League in USA, 'Hydrogen Alpha Solar Observing Program', https://www.astroleague.org/content/hydrogen-alpha-solar-observing-program 2018

If you decide to use your telescope and solar filter, then read our accompanying SAFETY INSTRUCTIONS document.

PRE-LAB ACTIVITY

You may find the NOVA Sun Lab Lesson Plan from PBS Learning Media suits your students.

https://www.pbslearningmedia.org/resource/nvsl.sci.space.lpsl/nova-sun-lab-lesson-plan/#.XJADwChKiUl

It includes short videos covering the structure of the Sun, features on the surface of the Sun, and the physics of light and telescopes.

AUSTRALIAN CURRICULUM: SCIENCE

Year 7 and 8 Science

Science Inquiry Skills

Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS129 and ACSIS144)

Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSIS130 and ACSIS145)

Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSIS133 and ACSIS148)

Year 9 and 10 Science

Science Inquiry Skills

Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSIS169 and ACSIS203)

Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170 and ACSIS204)

Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS174 and ACSIS208)

SUGGESTED ANSWERS

1. How do SOHO's or SDO's images compare to your observations? Think about the number of sunspots you saw compared to SOHO's or SDO's images. What advantages do these space telescopes have over you?

Students are likely to come up with some creative answers to the second part of this question.

SOHO and SDO are in space, and so doesn't have to worry about the Earth's atmosphere interfering with the light from the Sun.

SOHO and SDO don't have a retina that can be damaged.

SOHO and SDO don't have to sleep! So observations can be made all of the time.

SOHO and SDO are closer to the Sun than we are.

SOHO and SDO can take longer observations than the human eye can, and so can see more detail.

SOHO and SDO have bigger pupils (so to speak) than the human eye does, and so can resolve more detail.

SOHO and SDO can look at the Sun using more than visible light.

2. b) Watch a sunspot as it moves left to right in the movie. What do you notice about it? How many days did it take from appearing on the left to disappearing on the right?

Should be about five days.

3. Now download the hmimag images for the same time period. You are now looking at the Sun's magnetic field. How is this different, and the same, from the images taken using visible light? Why do you think scientists study the Sun's magnetic field?

The last question will illicit a range of answers, as students are not likely to be familiar with magnetic fields.

The accurate answer is that it allows scientists to see the magnetic fields both at the surface, and under the surface of the Sun.

POST-LAB ACTIVITY

Watch this detailed video from NASA that explains the work of SDO through detailed animations and interviews with scientists, (12:24 mins).

'Journey into the Sun - KQED QUEST', YouTube (12.24 min), https://youtu.be/fqKFQ7z0Nuk
14 May 2010