

# The Sun

## Outdoor Observing of the Sun

There will be three stations set up outside to view the sun. You will record the visible features of the sun in on the following pages.

**Never look directly at the Sun!**

The three stations are:

- A. The Projection of the Sun
- B. Telescope with solar filter
- C. The H-alpha Image of the Sun

You will need to bring:

- A ruler
- Your lab printout
- A writing utensil

**Before you return to the lab, make sure you complete questions 1, 2, and 3 and 4 for the projection, question 10 and 11 for the filtered white light telescope, and questions 12 and 13 for the H-alpha image.**

## A. The Projection of the Sun

The solar image can be projected onto a piece of paper using a simple lens system. Instead of focusing the Sun's light to a point (which can set the paper on fire), we use a combination of lenses and mirrors to create a magnified image and spread the light out over a larger area.

1. Measure the size of the projected image's diameter in cm with a ruler. Compare with other student measurements and include an estimate of the uncertainty in your measurement:
2. Measure the size of the largest sunspot in the projected image. Compare with other student measurements and include an estimate of the uncertainty in your measurement:
3. Carefully draw an image of the Sun in visible light. Including any features you see (sunspots, faculae, granulation, limb darkening).

|                        |  |
|------------------------|--|
| <b>Date:</b>           |  |
| <b>Time:</b>           |  |
| <b>Scale of image:</b> |  |

4. Give a brief written description of the features in your drawing.
  
  
  
  
  
  
  
  
  
  
5. The diameter of the Sun is  $1.4 \times 10^6$  km. Divide the actual diameter of the Sun in km by your measurement of the diameter in the projected image. How many km are there in 1 cm of the projected image?
  
  
  
  
  
  
  
  
  
  
6. Calculate the diameter of the sunspot on the Sun in km.
  
  
  
  
  
  
  
  
  
  
7. Calculate the scale of the image you drew on the previous page. How many km are there in 1 cm of your drawing? Write the scale below your drawing.
  
  
  
  
  
  
  
  
  
  
8. The diameter of the Earth is 13,000 km. What size would the Earth be in your drawing?
  
  
  
  
  
  
  
  
  
  
9. How many Earths can you fit into the largest Sun spot? Draw an Earth into your picture for scale.

## **B. The visible light filter**

A strong filter is used to evenly dim the light coming from the sun before it enters the telescope. The filter appears to be a reflective film, since it blocks such a large fraction of light. The telescope then magnifies the solar image for viewing by eye.

10. Carefully draw an image of the Sun in visible light. Including any features you see (sunspots, faculae, granulation, limb darkening). Draw the sunspot groups including the umbra and penumbra (label the umbra, penumbra).

**Date:**

**Time:**

11. Give a brief written description of the features in your drawing:

### C. The H-alpha filter

A H-alpha ( $H\alpha$ ) filter can also be used to block all wavelengths except 656.28 nm. It lets through the light that is emitted by hot hydrogen gas in the chromosphere of the sun.

12. Sketch the filtered image of the Sun including any features you see (sunspots, filaments, prominences). You may be able to see the same sunspot groups as the projection, but they will be dimmer.

|                        |  |
|------------------------|--|
| <b>Date:</b>           |  |
| <b>Time:</b>           |  |
| <b>Scale of image:</b> |  |

13. Estimate the height of the prominences compared the Sun's diameter (a fraction of the Sun's diameter). Measure your drawing for an accurate estimate.