

## **Hands-On Tracking Sunspots!**

This activity was developed by the Project SEE team, who thank Steele Hill (Goddard Space Flight Center) and Lindsay Yazzolino for their assistance.

### A little background about the Sun:

The Sun is our closest star and on average, is about 93 million miles away. On a sunny day, you may feel the warm sun on your face. The Sun's light and heat allow life to exist and flourish on Earth.

Compared to Earth, the Sun is huge. One million Earths could fit inside it.

The Sun is composed mostly of hydrogen and helium gases. It has a central core that cannot be seen directly but outer layers that can be observed under different occasions. It is not safe to view the Sun without a special safe dark solar filter.

The photosphere is a bright layer of the Sun where sunspots form. Sunspots are dark only because they are cooler than the surrounding gases by about 1500 degrees! If you could somehow remove a sunspot and hold it away from the sun, it would glow! Sunspots are huge and can form in groups that are even larger than the Earth.

If you have ever played with a magnet than you know that magnets can stick together if you put a positive and a negative end together. It turns out that sunspots are found in areas of magnetic activity on the Sun.

In the early 1600s, Galileo first recorded sunspots using a telescope. Sunspots can last for weeks or even several months and can be used to track the rotation rate of the Sun. In this activity, you will measure the motion of sunspots to determine how long it takes the sun to rotate!

## Procedure:

The following 13 images of the sun are labeled June 21 through July 3 and were taken by the Solar and Heliospheric Observatory (SOHO) that observes the Sun from space. They were all taken around the same time each day.

The date for each picture appears on its upper left corner. Each Sun image is superimposed with a grid that shows latitude and longitude, with 15 degrees separating each line. Sunspots appear as solid irregularly shaped dark spots on the Sun. Print and Braille versions of each observation date are available. On the Braille version, the number signs for the longitude markers are sandwiched between the corresponding grid line. For example, in minus 15 degrees longitude, you will find the minus and number sign on one side of the longitude line and the 1 and 5 on the other side of the longitude line.

Organize all of the Sun images in chronological order, starting with June 21.

Scan the June 21 image and locate the sunspots. Assign number labels for at least seven sunspots.

Compare the June 21 image to the subsequent days' images, arranged in chronological order. Locate sunspots that appear to shift their position each day.

Using the longitude labels, estimate how many degrees a particular sunspot or sunspot group moved each day and record your information. In some cases you will have to approximate the latitude of sunspots using the longitude lines as your reference.

Create a table or list for the following information: spot number, date, latitude, longitude, and comments about any changes in the shape or size of each sunspot.

### Analysis:

Do the sunspots change their latitude and longitude each day?

To get the average daily movement for each sunspot, add the total number of degrees of change each day for a given sunspot and then divide by the number of days you observed that sunspot. You'll need to do this for each sunspot you tracked.

How many degrees of longitude did each sunspot move every day?

Did all the sunspots move at the same rate across the sun?

What was the average rate of change in longitude for the sunspots?

Did any of the sunspots change their shape and size?

Your Conclusion:

Take your average rate of change per day and add in 1 degree (because the Earth moves about the Sun in the same direction by about 1 degree). Now divide 360 degrees by your new average rate to figure out the average rotation period of the Sun.

Based on your observations, approximately how long does it take for the sun to rotate?

The rate of rotation that you determined is an “average” because the sun is a gaseous body and does not rotate at the same speed all over; it rotates once every 27 days near the equator and once every 35 days near the poles!