DIY
SUN SCIENCE

Measure the Sun's Size

How can you measure the Sun's real size?

Description

Make a pinhole viewer, and use it to measure the Sun's size. You will need a bright sunny day.

Age Level: 10 and up

Materials

- sheet of cardboard (like from a cereal box)
- piece of white paper
- small piece of aluminum foil, about 3 cm x 3 cm
- pin or thumbtack
- scissors
- tape
- ruler
- string or yarn (about 60 cm long)
- hardcover book (optional)

Time

Preparation: 5 minutes
Activity: 20 minutes
Cleanup: 5 minutes

Safety

Never look directly at the Sun!

Step 1

Cut a square about 1.5 cm x 1.5 cm from the center of the cardboard. Tape the piece of aluminum foil over the square.

Step 2

Carefully use a pin or thumbtack to prick a hole in the center of the aluminum foil. You have now created a pinhole viewer.

Step 3

While you're outside, hold the piece of white paper behind the pinhole viewer, so that sunlight shines through the hole and projects a circular image on the paper. Try to make the distance between the pinhole and the paper as large as possible.

Tip Taping the white paper to a book will help keep the paper upright.

Step 4

While holding the pinhole viewer steady, measure the size of the Sun's image on the piece of paper in centimeters. Record this measurement below.

Step 5

While still holding the pinhole viewer steady, stretch a piece of string between the pinhole and the piece of paper. Measure that length of string in centimeters. Record this measurement below.

Tip

It would be useful to have a friend help you with the measuring.

Step 6

The equation on the right is used to calculate the Sun's diameter. Using sun image size (d) and the string length (l) you recorded above, along with the distance from the Sun to Earth (L), calculate the diameter of the Sun. Below is the actual diameter of the Sun.

distance from Sun to Earth (L) = 149,600,000 km
actual Sun diameter (D) = 1,392,000 km

$$\frac{\text{diameter of Sun (D)}}{\text{distance from Sun to Earth (L)}} = \frac{\text{image size (d)}}{\text{distance from image to pinhole (l)}}$$

$$\frac{D}{L} = \frac{d}{l}$$

$$D = L \times \frac{d}{l}$$

How close was your diameter to the actual diameter?

What's Going on?

The Sun's light enters the pinhole and creates an image on the white piece of paper. Because of the geometry of the setup, we can use ratios to solve for the Sun's real size. The ratio of the Sun's size (D) to the distance between Earth and the Sun (L) is D/L. This ratio is equal to the ratio of the Sun's image size (d) to the distance between the pinhole and the image (l) or d/l.

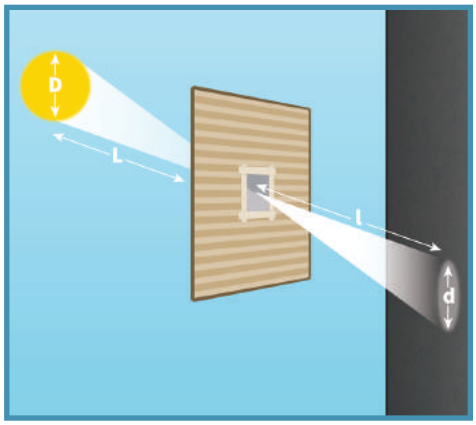
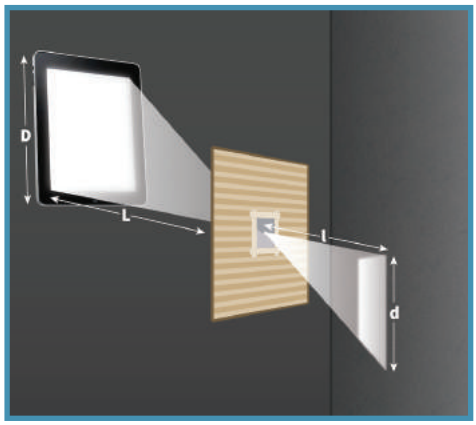
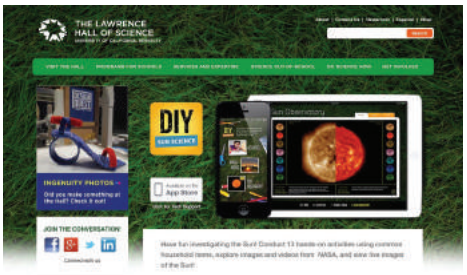


Image from a tablet

You can also try this measuring activity using the screen of a tablet or smartphone as the "Sun" in a dark room. Cast an image through the same pinhole viewer on a wall or a sheet of paper. If you measure L, l, and d as seen in the image below, you can calculate D (the height of your screen) just as you did for the size of the Sun. How close is your measured value to the real size of your tablet or smartphone screen?



Learn More



For more info and other activities, visit:

LawrenceHallofScience.org/do_science_now/diy_sun_science

Credits

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THE LAWRENCE HALL OF SCIENCE

The DIY Sun Science app allows families and educators to investigate and learn about the Sun at home, at school, or anywhere you go! The app features thirteen hands-on investigations, as well as images and videos.

Activity inspired by "Finding the Size of the Sun and Moon," Space Science Lab, University of California, Berkeley.