How Big is the Sun?

Exploring the size and scale of the Sun, Moon and Earth

Age: 6 +

Activity Time: 60 min

Prep Time: 15 min

Summary

The Sun is the largest object in our solar system - but how big exactly? In this project, students get a sense of scale by working together to paint a large poster of the Sun and then lining up the exact number of Earths that would fit end to end across the diameter of the Sun. More scale is added by lining up the number of Moons that fit across the diameter of the Earth. Take it even further by embelishing the Sun with common features of the photosphere, like sunspots and coronal loops.

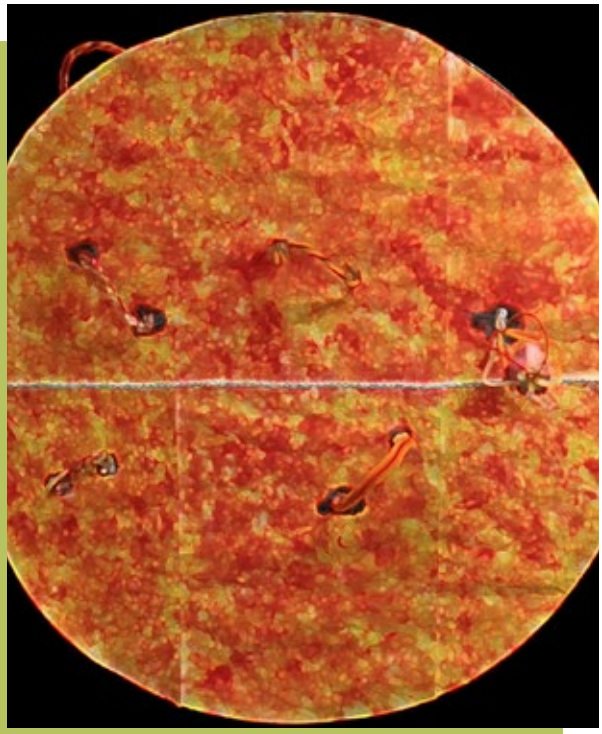
Credit: Activity created by Project FIRST and adapted by NSO
http://www.eyeonthesky.org/lessonplans/03sun_howbig.html

Objectives

- Draw and paint a model of the Sun.
- Learn that 109 Earths span the diameter of the Sun.
- Learn that 4 Moons span the diameter of the Earth.
- Learn about features of the Sun: sunspots, filaments, coronal loops, granules.

Materials

- ❑ Butcher paper or several sheets of paper/cardstock placed side by side to make 55" x 55" square
- ❑ Yellow, orange, red and black tempera paint
- ❑ Pencil or marker
- ❑ White construction paper cut into 2-inch x 4-inch pieces for labels
- ❑ Tape
- ❑ Sponges and brushes
- ❑ Half-inch round Avery adhesive labels (blue)
- ❑ 4 small pins with round heads
- ❑ Pushpin
- ❑ String
- ❑ Pipecleaners, ribbon
- ❑ Yardstick or measuring tape



NOTICE: Tempera paint is water-based and designed to wash out of clothes, however, care should be taken to avoid getting paint on fabrics like clothes and carpeting.

Science Background

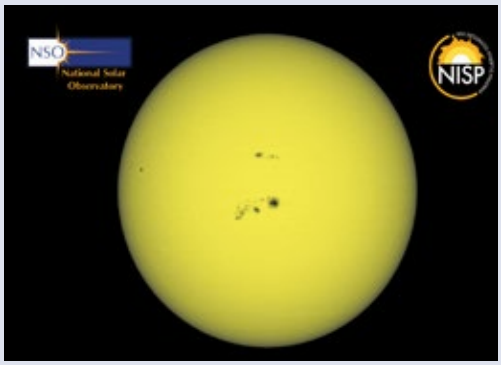
"Space is big. You just won't believe how vastly, hugely, mind- bogglingly big it is."
- Douglas Adams

The Sun is the largest object in our solar system. The Sun is so massive that even though it is mainly made up of the two lightest elements, hydrogen and helium, it accounts for 99.9% of the mass of the solar system! Understanding just how big it is may be difficult to get your brain around. The table below relates the size of the Sun to two objects that we have more direct experience with - the Earth and the Moon:

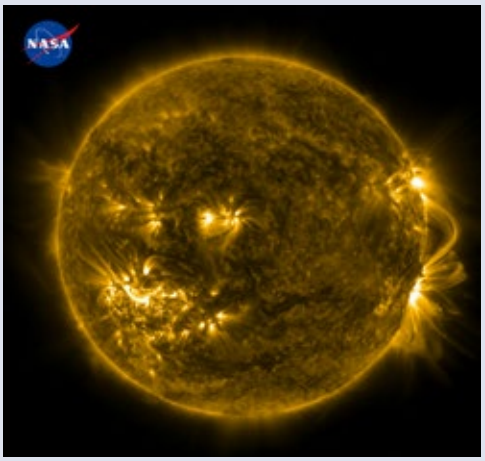
	Sun	Earth	Moon
Diameter	864,576 miles 1.4 million kilometers	7,918 miles 12,742 kilometers	2,159 miles 3,474 kilometers

The Sun is over 109 times the size of the Earth in diameter. And the Earth is no slouch - it is a little more than 3.5 times the size of the Moon in diameter.

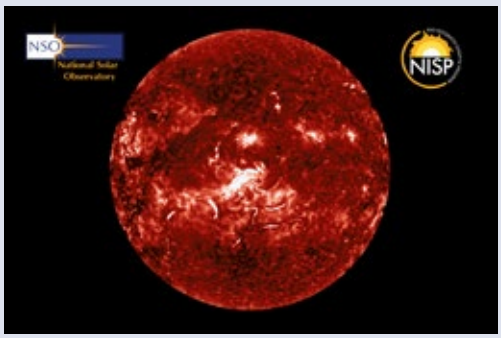
Features on the Sun:



Sunspots *are dark regions on the Sun's photosphere that last from days to months. They are associated with magnetic field emerging from the interior of the Sun and frequently occur along with other magnetic phenomenon like prominences, filaments and coronal mass ejections. Sunspots are dark because they are a few thousand degrees cooler (3,00 K) than the surrounding regions (5,700 K).*



Coronal loops *are huge arcs of plasma that arise from the surface of the Sun into its atmosphere and reconnect at the surface to make a loop. These loops are also a consequence of the magnetic field of the Sun, which is constantly being twisted and wound up, protruding from the surface.*

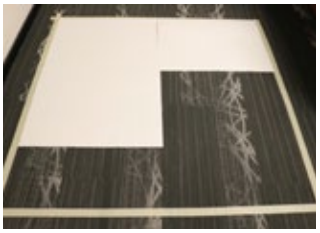


Filaments *are just like coronal loops, except that they occur quiet regions, not above sunspots. Solar* **prominences** *are filaments that occur at the limb (edge of the disk) of the Sun, whereas filaments on the face of the disk of the Sun.*

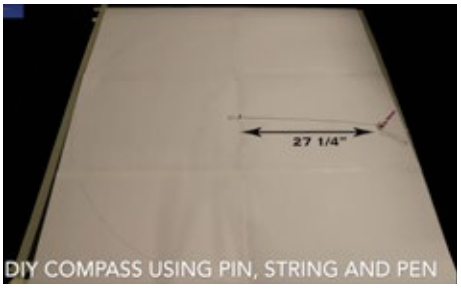
Procedure

Set Up:

1. Unless you have a 54.5" square sheet of paper, you will need to make your own. Most butcher paper is 36" wide, so if you have some, you can tape together two 28" long sheets. Otherwise, tape together the largest sheets of paper or cardstock available to you into one big piece at least 55" x 55" large (This is 139 cm x 139 cm for those using metric).



2. Draw a circle with radius 27.25" (69.2 cm) on your big sheet of paper with pencil. To do this, start by taping your paper to the floor. Anchor one end of the string at the center using the pushpin or tape and tie the other end to the bottom of your pencil 27.25" from that point- you've made a compass! Just keep the string taut and move your pencil around 360 degrees to draw a circle.



3. Cut out the circle, which is now ready to be made into the Sun.

4. Prepare an area for painting. Put down a tarp or newspaper to protect the floors, walls and furniture.

A NOTE ON SCALE:

A 54.5" diameter Sun was selected here so that one hundred and nine 1/2" blue stickers would fit perfectly across the diameter of the Sun, since the real Sun is 109 times the diameter of the real Earth. You may wish to scale your model up or down depending on the size of the stickers you have and/or your preference. For scaling with a different sticker size, just multiply the diameter of the sticker by 109 to get the diameter of the Sun. You can also use this handy website to find the sizes of all the planets, the Moon and the Sun and their relative distances for any scale:

http://www.exploratorium.edu/ronh/solar_system/

Procedure

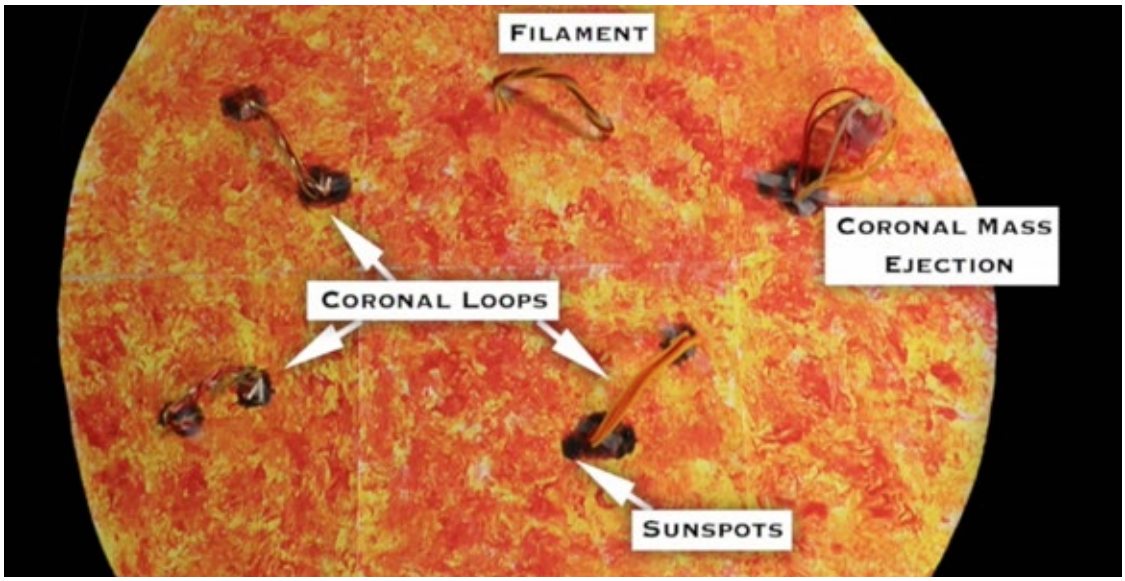
With your students:

Credit: NASA

1. Show your students some images of the Sun. Have them note the colors and textures. Go over the features listed in the Science background section on the previous page.

2. Start painting! Have the students take turns painting the circle you made to look like the Sun, starting with yellow and then adding orange and some red. (Although tempera paint is unlikely to stain, you may wish to provide smocks to reduce the chance of anyone getting paint on their clothes).

3. After your Sun has dried, it's time to add features. Have the students paint some sunspots with black tempera paint. Create filaments, prominences and coronal loops with pipe cleaners and ribbon. Tape, glue or staple them to your Sun.



4. Ask students to write vocabulary words on the 2-inch x 4-inch labels.

6. Hang the Sun model up on the wall and have the students take turns gluing the vocabulary labels to the Sun.

7. Discuss the enormous size of the Sun in contrast to the Earth and the Moon.

Procedure

8. Ask students to imagine that one round blue label is the Earth. You can add green splotches in the shape of continents with tempera paint to make these circles look more Earth-like. Ask a group of students to place the round labels across the diameter of the Sun.

9. After placing the labels, ask students to count them in intervals of ten. Mark each group of ten. You will find that approximately 109 Earths span the diameter of the Sun.

10. Explain that it takes 4 Moons to cover the diameter of the Earth. Tell students that one small pin represents the Moon. Ask how many pins are needed to span the diameter of Earth. Place four small pins with round white heads across the blue label.

Take It One Step Further:

11. Have your students figure out how far away the Earth would be from the Sun for the relative sizes you have used (the Sun is 93 million miles or 149.6 million kilometers away). Check your answers using a calculator or go to this website to confirm: http://www.exploratorium.edu/ronh/solar_system/

12. Go outside and pace out this distance with your model Sun. First measure the size of one students average step, then divide the distance to the Earth for this scale model by that distance and have that student take that many steps away. Wow! The solar system is a big place!

Watch a video tutorial of this activity on YouTube:

http://bit.ly/HowBigIsTheSun

Find out more by watching our solar magnetism webcast:

http://bit.ly/Webcast1-PreparingForTheEclipse

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