WHY DO ECLIPSES HAPPEN?
ACTIVITY INSTRUCTIONS

OBJECTIVES

- Understand what causes solar and lunar eclipses.

ACTIVITY DURATION

10 minutes (plus 10 minutes if also doing "Why Does the Moon Have Phases?")

MATERIALS

- "Moon balls" (polystyrene balls, included in Star Party host kit)
- Craft sticks (included in Star Party host kit)
- A light source – the Sun or a lamp with the shade removed
- *Optional: eclipse glasses*
- *Optional: hula hoop*

SETTING

- Option A: Outdoors on a sunny day (use the real Sun as your light source)
- Option B: Inside a darkened room (use a lamp with the shade removed as your light source; place the lamp on a table so that the bare bulb is at roughly shoulder level)

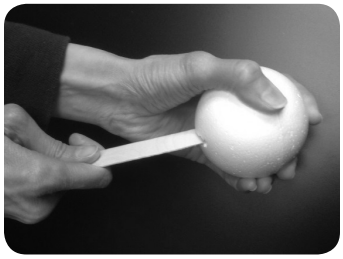
MORE RESOURCES

"Astronomy Activity: Why do Eclipses Happen?"
http://www.youtube.com/watch?v=gccoj9T9ycg
(You can also find this video at http://www.youtube.com/user/NightSkyNetwork)

A 6-minute video of a similar activity. The beginning of the video demonstrates eclipses in an outdoor daytime setting and handles the question of correct scale. The last part of the video demonstrates why eclipses don't happen every month.

PREPARATION

1. Insert a craft stick into each "Moon ball" to make the balls easier to hold and observe.



2. *Indoors version:* Remove the shade from a lamp, and place the lamp on a table. You want the bare bulb to be at roughly shoulder level. Choose an interior room that can be made as dark as possible. Once you've handed out the Moon balls, your "Sun lamp" should be the only light source.

PROCEDURE

1. Ask a couple of questions to gauge your audience's prior knowledge, e.g., Does anyone know what an eclipse is? Has anyone ever seen an eclipse?
2. "Let's find out why eclipses happen." Hand out the Moon balls.
3. If you haven't already done the activity "Why Does the Moon Go Through Phases?" go over the first part of it:
   a. Tell visitors that their ball will represent the Moon, and their head will represent Earth. They might imagine that their nose is North Carolina and a little person stands on the tip of their nose looking up at the sky.
   b. Confirm that everyone is clear on where the real Earth is (point to the ground or the floor – "we're standing on it"). *If you're outdoors and the real Moon is in the sky:* ask people to point to the Moon.
   c. *If indoors:* Turn off all lights except for your Sun lamp, and ask everyone what they think the bulb is supposed to represent (the Sun). *If outdoors:* Ask where the real Sun is (point to it in the sky).
   d. Ask why the Moon shines. Does the Moon make its own light? (No.) Then where does the light come from? (From the Sun. The Moon reflects sunlight.)
   e. Show how the Moon orbits Earth, by turning yourself and your Moon ball counterclockwise (to the left).
4. Ask your audience to make a lunar eclipse – when the Moon passes through Earth's shadow.

Procedures continue on reverse

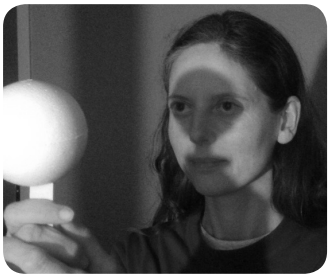
PROCEDURE, CONTINUED

They should experiment with making their Moon ball go through their Earth head's shadow. (Note: The phase must be Full Moon for there to be a possibility of a lunar eclipse. Therefore, each person should have their backs to the Sun, with the Moon ball held low enough that the shadow of their Earth head falls onto the ball).

5. Ask where you would have to be on Earth to see a lunar eclipse. (The night side of Earth.)

6. Next, model a solar eclipse – when the Moon casts a shadow on Earth.

   a. *If indoors:* You can have your visitors model a solar eclipse themselves. They should hold their Moon ball between their Earth head and the Sun lamp, so that the Moon ball appears to cover up the Sun. While everyone is making a solar eclipse, have them glance around to observe how the shadow of each person's Moon ball falls onto their Earth head.



   b. *If outdoors:* **CAUTION!** You don't want your visitors staring at the Sun. To avoid this, you should be the only one who models a solar eclipse. **Be careful not to look directly at the Sun yourself.** You can face the Sun with your eyes shut. Choose an adult volunteer to take a Moon ball and hold it between your head and the Sun such that the Moon ball casts a shadow on your Earth head. (Alternatively, if available, wear eclipse glasses made for looking at the Sun safely.) Invite your visitors to observe the shadow of the Moon ball falling onto your Earth head.

7. Ask where you would have to be on Earth to witness a solar eclipse. (The part where the Moon's shadow crosses. Everyone there would see the Sun blocked out by the Moon. We hope everyone there is observing the eclipse safety, such as with eclipse glasses or by viewing a projected image.)

8. Ask whether eclipses happen every month. Is there a lunar eclipse at every Full Moon? Is there a solar eclipse at every New Moon? (No. Usually the Moon, Earth and Sun aren't perfectly aligned. The Moon's orbit around Earth is tilted 5 degrees compared with Earth's orbit around the Sun—you can hold up a hula hoop around your head to model the Moon's orbit and then tilt it slightly to demonstrate the tilt. Usually at Full Moon the Earth's shadow passes above or below the Moon, and there is no lunar eclipse. And usually at New Moon the Moon passes above or below the Sun, and there is no solar eclipse. Also, our model is not to scale so it's a little easier than it should be to cause eclipses.)

PRESENTATION TIPS

- This activity is a great follow-up to the activity "Why Does the Moon Have Phases?"
- Help visitors arrange themselves so their own shadows don't inadvertently create eclipses for one another. *For the indoor version of the activity:* have people spread out into a large circle around your "Sun lamp."
- Remind visitors that it is not safe to look directly at the Sun and they must *never* use binoculars or a telescope to look at the Sun (exception: solar telescope with a proper solar filter that is properly attached).
- The Sun-Earth-Moon model will not be to scale. The Moon is about 30 Earth diameters away from Earth. A Moon ball held at arm's length from your Earth head is not far enough away to represent this distance to scale.

LUNAR ECLIPSE DATES

Upcoming lunar eclipses visible from North Carolina:

- Tuesday morning, April 15, 2014. Totality is from 3:06 a.m. to 4:24 a.m. EST.
- Wednesday morning, Oct. 8, 2014. Totality is from 6:25 a.m. to 7:24 a.m. EST. For parts of North Carolina, the Moon sets before the end of totality.

CREDITS

We are grateful to the NASA Night Sky Network (http://nightsky.jpl.nasa.gov/) and the Astronomical Society of the Pacific for granting permission to modify materials they created.

NORTH CAROLINA space grant

The Statewide Star Party is made possible by the generous grant support of the North Carolina Space Grant.