WHY IS IT UPSIDE DOWN?

ACTIVITY INSTRUCTIONS

http://www.ncsciencefestival.org/starparty

OBJECTIVE

Discover why many telescopes invert the image.

SUGGESTED AGE RANGE

Ages 5 and up

ACTIVITY DURATION

2-10 minutes, depending on extensions and discussion time

SETTING

Indoors or outdoors

MATERIALS

- Spoon
- Foam strip with skewer sticks
- Optional: reflector telescope

PREPARATION

Insert the sticks into the foam. You want the sticks as evenly spaced, vertical, and parallel as possible. Recommended: Glue the sticks into the holes.

PROCEDURE

Main activity: Why is it upside down?

1. Ask if anyone has seen the Moon through a telescope and noticed that it looked upside down. Let's explore why that is.
2. Hand one of your participants a spoon. If it's too dark to otherwise see their reflection, shine a red light indirectly toward their face.
3. Have them hold the spoon a couple of feet from their face and look at themselves in the bowl of the spoon.
4. Ask them, "How do you look?" (Upside down!)

PROCEDURE (CONTINUED)

5. Explain that the spoon's surface is curved, just like some telescopes have a curved mirror inside them. (The mirror collects and concentrates the light from the object you're observing.) If you have a reflector telescope available and it's still daylight, you can invite participants to stand about 5 to 8 feet in front of the telescope and look down the barrel to see the mirror.
6. Hold the foam and sticks next to your face to demonstrate, and tell your participants, "When you look in a flat mirror, the light comes straight back out at you. The top spoke is where your forehead is, and the bottom spoke is where your chin is. But a spoon is curved—and so is the telescope mirror."

7. Holding the foam strip next to your face, curve the foam strip so that the sticks cross over one another.

8. Ask, "NOW where's your forehead and where's your chin?" (Reversed!)
9. Explain that the same thing is happening in a telescope's curved mirror.
10. If you wish, elaborate: You could put one more mirror or lens in the path of the light in the telescope to turn the image right side up again, but with each additional element (lens or mirror), some light is lost. For astronomers it's more important not to lose that dim light than it is to have the image "right" side up.

PROCEDURE (CONTINUED)

Extension #1: flipping right for left

11. While a participant in looking in the bowl of the spoon, have them raise their right hand. Ask, "What do you notice?" (The opposite hand of their upside-down reflection is raised.)

12. Hold the foam and sticks horizontally.

13. Then hand the foam and sticks to the participant, and ask them if they can figure out why. Or talk them through it while they bend the foam.
14. Remind them that when you look in a flat mirror, the light comes straight back out at you. Point out that here's your right hand, here's your left.
15. Tell them that a spoon is curved—and so is the telescope mirror. Help them curve the foam strip, and ask "NOW where is your right hand?"

Extension #2: right side up, but elongated

16. Ask a participant to look at the other side of the spoon (the convex side). Ask, "What do you notice about your image now?" (It's right side up, but elongated.)
17. Hand the foam and sticks to the participant, and ask them if they can figure out why. Or talk them through it while they bend the foam, e.g., ask, "Why are you right side up? Can you curve the foam to show me how the spoon is curved on that side?"

TIP

Hold the foam at either end, so that if you need to, you can use your fingers to position the sticks at the end.

MORE RESOURCES

1. Watch a 2-minute video demo at https://www.youtube.com/watch?v=N_S7IlUkn90
   You can also find the video at http://www.youtube.com/user/NightSkyNetwork
2. Learn more about how a telescope's optics are related to the view you'll see:
   https://www.skyandtelescope.com/astronomy-equipment/10-top-telescope-questions/#4

CREDIT

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