

Star Power

Create a Star Show and Learn How You Can Prevent Light Pollution

The stars in the night sky have fascinated humans since we first walked the Earth. But today, electric outdoor lighting threatens our ability to see the stars. Light pollution is a real problem, and not just for astronomers. Animals become disoriented from the excess light, which can disrupt their mating, migration, and predation behaviors. For example, sea turtle hatchlings follow light from the moon to find their way to the ocean, but coastline lighting can lure them toward roads and predators.

You'll Need (per small group)

2 Hours

Part 1

- shoe box (narrow style) or rectangular tissue box and extra paperboard (e.g., cereal box)
- 3" x 5" index card
- tape (duct or masking)
- scissors
- pushpin
- single-bulb LED keychain light
- optional: book or website that contains drawings of constellations
- construction paper, glue, markers, crayons, colored pencils

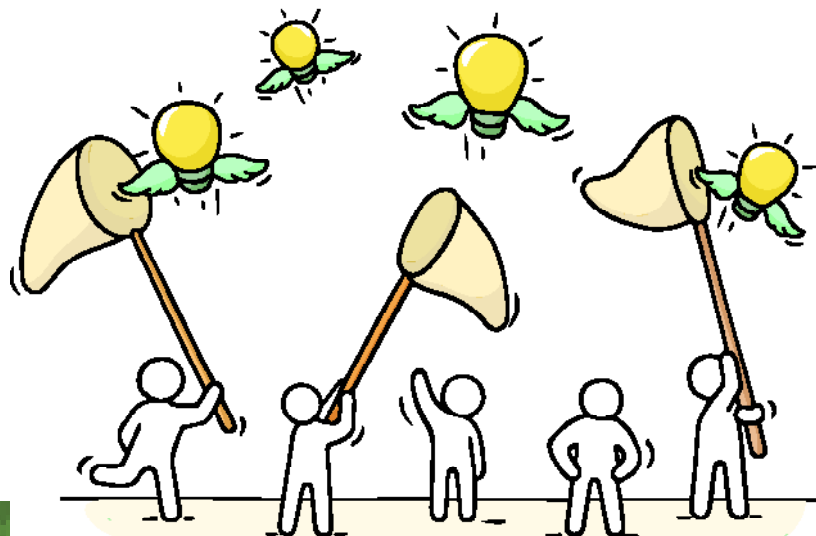
Part 2

- aluminum foil
- paperboard (e.g., cereal box)
- tape (duct or masking)
- scissors



BE ECO-FRIENDLY!

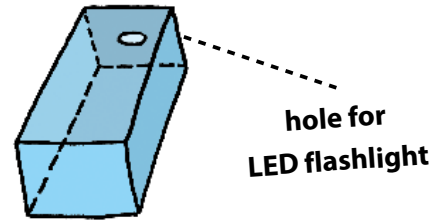
Reduce, reuse, recycle, and compost activity materials whenever possible!



Star Power

Part 1: Design a Constellation Box

1. Introduce constellations. Ask youth to name their favorite constellations. (Use books or the Internet for help.) Do they know what each constellation represents and the myths associated with it? (Constellation myths are stories that explain how stars and their positions in the sky came to be, and are different in different cultures.) Share the myth about your own favorite constellation with your youth. ¹



2. Prep the constellation box. Break into small groups. ⁵ Each group gets one box, which must be completely enclosed. If using a shoe box, they should tape the lid on tightly. If using a rectangular tissue box, they should cut a piece of paperboard (e.g., from a cereal box) and tape it over the opening. Then girls should cut a hole—just big enough to fit the LED flashlight—in the center of one of the small ends of the box.

3. Choose a constellation. Ask each group to choose one constellation to display with their constellation box. Guide each group to choose a different constellation so you have a variety to display.



4. Make a constellation template. Have groups sketch their constellation on an index card, and then use a pushpin to poke the stars of the constellation in the card. Now, flip the card over, so youth are looking at the **mirror image** of the constellation.

5. Use the template to poke holes in the constellation box. Have youth tape the card over the other small end of the box and use a pushpin to poke the stars of the **mirror image** of the constellation in the box. Otherwise, it will project backward! (See above.) Groups can now remove the card. Youth who finish early can decorate their constellation box with images depicting their myth.

6. Display constellations. Hand out an LED flashlight to each group. Remind youth not to shine the light in anyone's eyes! One youth in each group should insert the flashlight into the hole at the end of the box. Then turn out the lights in the room, and tell the youth to aim the constellations at the ceiling or a wall. They can experiment with holding the box at different distances. Have each group shine its constellation one at a time and share what it represents and its myth. ²

Star Power

Part 2: Prevent Light Pollution

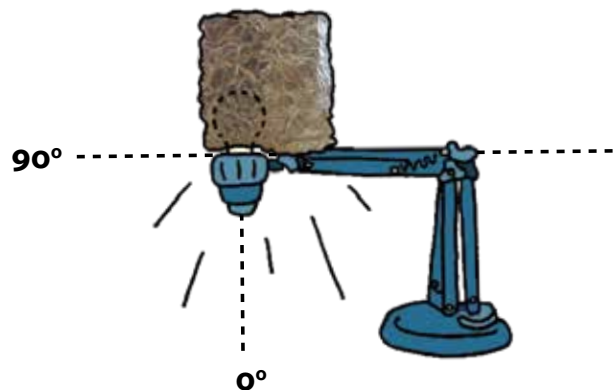
7. Introduce light pollution. Light pollution is light that is not doing what, or directed where, it should be. Can youth think of situations in which light would be considered a pollutant? (E.g., light preventing the viewing of stars, shining into a window and on a property, or creating an uncomfortable glare). Ask how this light might be harmful. (E.g., wastes energy and money, interrupts sleep, interferes with behavior of nocturnal animals).¹

8. Demonstrate light pollution. Place a desk lamp on a table in the center of the room and aim the bulb toward the ceiling. Before you turn on the lamp, spread out the constellation boxes, having some youth stand near the lamp and some far away. Tell them the lamp represents city light. (Areas close represent the city and areas farther away represent suburban and rural areas.) Turn on the lamp. What happened to the constellations? Can you see the constellations in each of the areas? Why or why not?

To see SciGirls identify good and bad lighting in their community, watch **Star Power** (Observe).



9. Experiment with light direction. Ask youth to consider the direction the light is shining. What effect does this have on the ground? Have a few youth sit underneath the lamp, and ask the others how well can they see their friends. How shadowy do they look? Would this kind of lighting make the night more or less safe? How might it affect nocturnal animals?



10. Build a light shield. Deliver the **SciGirls Challenge**: How can you shield a light to reduce light pollution and increase visibility of constellations? Pass out the supplies for Part 2 and let each group brainstorm and sketch ways to redirect the light coming from this streetlight in the “city” to where it would be most useful.² Guide them toward building a shield for the light bulb. (Shielded light should not extend past a 90° angle.)



SAFETY FIRST: Use aluminum foil to line the inside of the paperboard light shield before placing it over the lamp bulb.

Star Power

POINTER: If youth are struggling, encourage everyone to share their creations. Then, point out the unique features of each group's design. Emphasize that even working scientists and engineers struggle when designing something new!



Watch SciGirls build a light shield in **Star Power** (Design).



11. Demonstrate a light shield. Shine the constellations on the ceiling, and hold each group's shield over the lamp. What do the "stars" look like now? Have a few youth sit underneath the lamp again. How visible are they now? Ask youth to come up with other ideas to reduce light pollution (timers, dimmers, motion sensors).²

12. Keep going. Take a walk around your building or neighborhood to examine the light fixtures.¹ (Look at the type of bulb, how long they are left on, and if they are shielded.)

This activity was adapted from the Dark Skies Awareness Rangers Program. For more investigations to try with your youth, check out darkskiesawareness.org.



Watch Gurtina tell the SciGirls about light pollution in **Star Power** (Mentor Moment).



Your group can also become citizen scientists, just like the SciGirls! For more information on participating in the Globe at Night a citizen science project to raise public awareness of the impact of light pollution visit <https://www.globeatnight.org/>



Challenge Stereotypes

Introduce youth to diverse role models to help counter stereotypes.^{4,6} Gurtina Besla is working on her PhD in astrophysics at Harvard. For the past several years, she has been a mentor for the Science Club for Girls in Boston, MA, guiding girls from elementary through middle school on various STEM adventures! She is excited to pursue a career in which she gets to study how galaxies evolve and teach students about space science.

