

SHEDDING LIGHT ON LIGHT

EXPERIMENT: SPECTROSCOPE

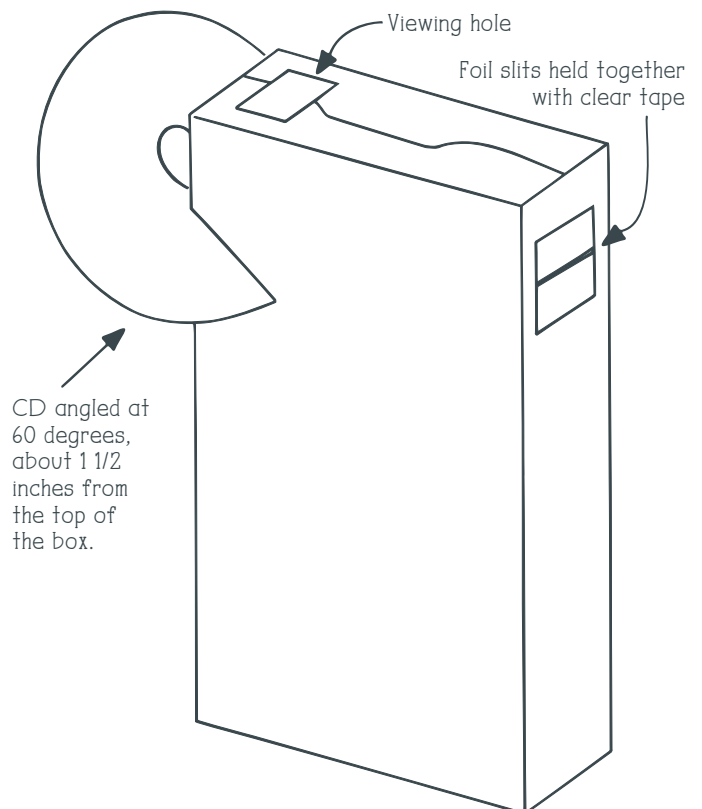
You can learn about stars and other objects in space by using tools to study them. A spectroscope measures the color of light that's reflected from a distant object, then analyzes that information to discover the object's chemical makeup. Build your own spectroscope and use it to examine different sources of light.

MATERIALS

- Cereal Box
- Aluminum foil
- Utility knife
- Scissors
- Ruler
- Pen
- Duct tape
- Clear packing tape
- CD that you don't mind ruining
- Protractor (msichicago.org/summerbrain)

INSTRUCTIONS

Light enters the spectroscope through a tiny slit on one of the long sides of the cereal box. From the bottom of the box, measure about 2 inches down and use a utility knife to cut out a narrow rectangle that's about an inch wide and 1/4 inch deep.



URANUS

I'm the only planet that's tilted sideways, probably because of a collision with an Earth-sized object. I look blue because of methane in my atmosphere.

The slit where the light enters needs to be narrow with clean edges. Cut two 1-inch-square pieces of aluminum foil from an edge of the roll, so at least one side is straight. Place a piece of clear packing tape about 2 inches long, sticky side up on the table. Put a piece of foil on the tape so the straight part from the edge is in the middle of the tape. There should be no wrinkles in the foil. Place the second piece of foil so that its straight edge is lined up parallel – and very close – to the foil already in place. There should be a very small gap between the pieces of foil that looks like a narrow line. Tape the foil slit horizontally over the rectangular hole.

On the side of the box opposite the slit, measure about 1 1/2 inches down from the bottom of the box and make a horizontal cut, then make a diagonal cut on the front and back of the box at about a 60 degree angle. Slide a CD into the angled cut so the shiny, playable side points up. Use duct tape to hold the CD in place and keep light from entering the box.

Cut out a viewing hole on the bottom of the box about an inch from the edge and directly above the angled CD. The hole should be about 1 inch wide and 1/2 inch deep. The CD acts like a reflector, so the viewing hole needs to be located where the light ends up after it bounces off the disc. Use duct tape to cover the top of the cereal box so that no light enters the box.

Point the slit at a bright light source like a light bulb and look through the viewing hole at the CD. You should see a rainbow. Try pointing the spectroscope at different types of lights, such as LED bulbs, street lights, neon lights or a computer monitor (but not the sun!). How does the rainbow pattern change?

WHAT'S HAPPENING?

Tiny grooves in the CD plastic act as a diffraction grating. A diffraction grating splits white light into its individual colors – the same way crystals or prisms make rainbows when sunlight shines through them. The colors present depend on how the light is made. Different types of light give off different combinations of colors (or wavelengths). Sunlight is made up of all different wavelengths, so you see a complete rainbow when split up. But some lights, like the neon signs on some storefronts, are only made up of one color wavelength.

GAME ON

Use your iPhone to analyze spectra with the SpectraSnapp app from the American Physical Society, available for free on iTunes.

TIPS

Don't use your spectroscope to stare at the sun!

MORE WAYS TO PLAY WITH LIGHT

Spectroscopes work on a similar principle as prisms, so check out the giant prisms in MSI's *Science Storms* exhibit.

RECOMMENDED READING

“Night Sky by Giles Sparrow”

“Space Atlas: A Voyage of Discovery for Young Astronauts”
by Jiří Dušek and Jan Pišala