TRY THIS —
Seeing the Invisible

Students observe the colors of the visible spectrum and detect invisible infrared electromagnetic radiation.

What's Needed

- 1 Diffraction grating
- 1 Overhead projector
- Masking tape
- Scissors

Audio Photocell Detector

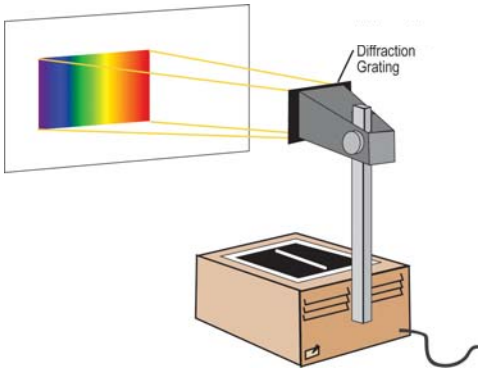
- Solar cell or photocell
- Amplifier/speaker (with battery if needed)
- Audio cable with 1/8-inch mini-plug on one end
- 2 jumper cables with alligator clips on both ends
- Small handheld fan

Getting Started

Set up the overhead projector so that it projects onto a light surface in a dark room. Place two halves of a sheet of dark construction paper on the projector's glass plate so there is a ¼-inch-wide slit between them through which light passes. Tape the sheets in place.

Place a sheet of diffraction grating in front of the projector head. Adjust the grating and projector until one or two spectra appear clearly on the wall. Tape the grating in place.

Build the audio photocell detector. Plug the 1/8-inch mini-plug into the "input" of the amplifier. Clip a jumper cable to one of the leads on the photocell, and clip the other end of the jumper cable to one of the leads of the audio cable. Use the second jumper cable to connect the other lead from the photocell to the other lead of the audio cable.



What to Do

- Invite the students to describe what they know about light. **What happens when light passes through a prism? How does a rainbow form?** Invite them to describe or define terms they use, such as white light, visible light, frequency, wavelength, colors, reflect, refract, and absorb.

- Turn on the overhead projector and explain that you are using a diffraction grating to break up the white light from the projector into the colors that make up white light — its spectrum. The diffraction grating acts like a prism. Ask a student to place pieces of masking tape on the wall where the red light begins and ends. **Do the other students think the marks are in the "right" place? If not, why not?** Each of us detects variations in colors differently, so students may have different opinions on where the tape should be.

- Show the students the photocell detector/amplifier and switch it on. Demonstrate that the amplifier/speaker emits noise when the photocell is placed in front of a light, such as the projector light, and that the noise is louder when the light is interrupted by a small fan (the instrument is sensitive to changes in light levels). Slowly pass the photocell in front of the spectrum on the wall, holding the fan in front of the photocell. **Which colors or wavelengths of light can the photocell detect? Are there any visible colors that it cannot detect?** It does not detect the violet light as easily as the other colors. **What happens to the detector when it is moved beyond the red light? Can it still detect light? What type of light could that be?** The photocell can "see" (detect) infrared light.

Wrapping Up

Ask the students which parts of the electromagnetic spectrum our eyes detect. We can see the visible light — red, orange, yellow, green, blue, and violet. **Are there parts of the spectrum we cannot see?** We cannot see infrared light, and other types of radiation such as X-rays, ultraviolet light, or radio waves.

In what way could looking at objects with different parts of the electromagnetic spectrum — those invisible to the human eye — provide useful information? X-rays provide information about the inside of our body and ultraviolet light is used to detect clues at crime scenes. Scientists detect electromagnetic radiation from stars to learn about their origin and condition. Spectrometers onboard spacecraft orbiting planets and our Moon collect electromagnetic radiation reflected from the surface, allowing scientists to learn about the composition.

For a more extensive lesson plan, and for related lessons, please visit the Moon Mineralogy Mapper Education website at http://m3.cofc.edu.