Invisible Light

By Pearl Tesler

The Moon Is Wet on page 15 describes the recent discovery of water on Earth's moon. The NASA scientists who made the discovery detected the water by measuring the light absorbed by the water. The light they measured was a certain kind of infrared light. What is infrared light, and how can it be used to detect water? Grab a TV remote control and find out.

What You Need

- a television with a remote control
- a black plastic trash bag
- a sheet of white paper
- a ziplock plastic bag full of water
- **optional:** a digital camera
- **optional:** a mirror, a sheet of plastic, or a shiny metal pan (not Teflon coated). A copper-bottom pan works best, but any shiny metal will work.

What to Do

1. Check that the remote control is working by using it to change channels on the TV.
2. Press any button on the remote control while looking at the end that you would normally point at the television. Do you see anything?
3. Now try changing channels while holding each of these items one at a time between the remote control and the TV:
   - a single layer of a black plastic trash bag
   - a sheet of white paper
   - a ziplock plastic bag full of water

   Does the remote control still work?

What Happens

The remote control fires a beam of *infrared light*, an invisible form of electromagnetic radiation. Electromagnetic radiation is energy in the form of waves of a wide range of frequencies. It travels through empty space at the speed of light and through materials at different speeds. The range of electromagnetic radiation is called the *electromagnetic spectrum*. It extends from low-frequency radio waves through microwaves, infrared waves, visible light, ultraviolet waves, and X-rays to very high-frequency gamma rays. Infrared light got its name because it is located near the red end of visible light on the spectrum. *Infra* means "below." Not only is infrared light invisible to human eyes, but it also interacts with materials differently than visible light does.

A black plastic trash bag blocks visible light but allows infrared light to pass through it, so the remote control should function. Paper allows infrared light to pass through it but scatters the beam, so the remote control should work only from a short distance. Water allows visible light to pass through it but absorbs infrared light, so the bag full of water should block the infrared remote control signal. NASA scientists used that property—water's ability to absorb infrared light—to confirm the presence of water on the moon.

Explore More

- If you have a digital camera, try pointing the remote at it while you watch the small screen on the camera. When you press a button on the remote control, look for a flashing light. The digital camera will "see" infrared light that our eyes can't.
- Try reflecting the beam off a mirror. To do that, point the remote at the image of the television in the mirror. You can also try bouncing the beam off the outside bottom of a shiny metal pan or a sheet of plastic, such as a plastic cutting board.

Infrared light reflects off mirrors and metal surfaces, such as the bottom of the pan. Plastic surfaces don't reflect infrared light very well.

Prism Drawing