

Herschel and infrared

Teacher Background

In 1800 the German-born English astronomer William Herschel examined the solar spectrum using prisms and heat-sensitive equipment, and discovered that temperatures continue to climb even where no colors appeared at the red end of the spectrum, meaning that some type of radiation existed before the red in the visible spectrum, leading to the discovery of infrared radiation.

Materials

- prism
- light source
- heat sensitive paper
- heat source
- 4 thermometers or probes

We can detect infrared radiation by using heat sensitive paper. Do this as a teacher demonstration. Place a portable hot plate (with a visible coil) on a demonstration table. Turn the heater on, and bring the heat sensitive paper close. As you approach, the color of the paper will change indicating that heat is present, though no light is being generated. This is infrared radiation. As time passes, the coils of the heater will begin to glow red. If this was a "magic" heater and continued to get hotter and hotter, the color would eventually change to orange, yellow, etc.--just as we can see stars do as their temperatures increase.

How did humans first realize heat and light were related? Duplicating Hershel's experiment with the kind of thermometers found in most schools science labs is "challenging"! But if you have access to a thermal probe you might want to attempt this.

Cast a large spectrum onto a table top using sunlight through an open window. Place thermometers or sensors in the violet and red bands of color, and just beyond the red end of the spectrum. Place a fourth thermometer well away from the other three to act as a control. See if you detect a temperature change. The different colors should generate different temperatures.

<http://sirtf.caltech.edu/EPO/Herschel/herschel.html>

For anyone attempting the Hershel Experiment, this site is a must. It includes a detailed description of how to set up the experiment as well as actual photos of the lab in action!