

Diffraction of Light by Very Small Apertures

Objective



The student will observe that when light passes through a small hole, it no longer travels in a straight line. The observed light pattern illustrates the wave behavior of light. The student will determine what light pattern is created by light passing through each diffraction screen.

Theory



When light passes through a small hole or a narrow slit, the light waves spread out. The hole or slit must be extremely small for the effect of this spreading to be seen. Each point of the hole or slit acts like a source of a spherical wave. At certain angles, the spherical waves from all the points will be in phase and will add to form a bright spot. At other angles the waves will be out of phase and will cancel to form a dark spot. The pattern of light and dark is called the diffraction pattern. The diffraction pattern depends on the shape of the aperture (square or slits). (See Glossary, page 73).

Science and Mathematics Standards



Science Standards

- Science as Inquiry
- Physical Science

Mathematics Standards

- Problem Solving
- Communication
- Connection
- Computation/Estimation
- Measurement

Materials



- 2 diffraction screens, one of narrow parallel slits and one of square apertures (See List of Catalogs, page 83.)
- a distant or point light source



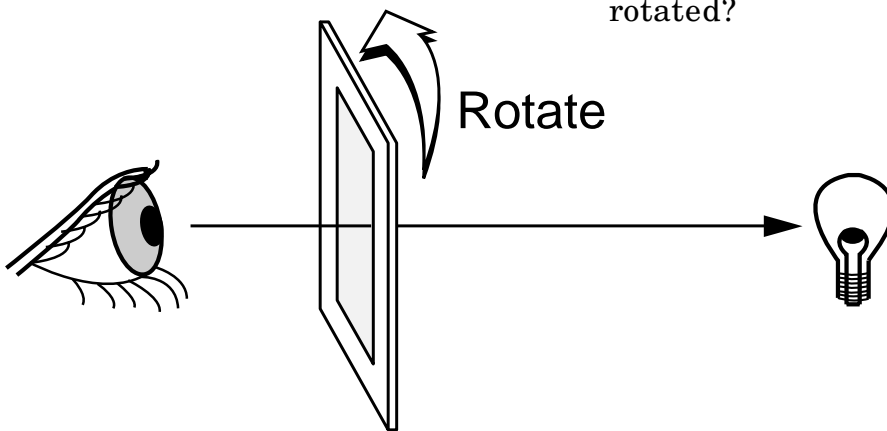


Procedures



Use both diffraction screens, one at a time.

1. Hold one diffraction screen by its edges and place it in front of your eyes. Look through it at a point source of light several feet away from you.



2. Slowly rotate the diffraction screen while continuing to look through it at the light source.
3. Repeat steps 1 and 2 with the other diffraction screen.

Observations, Data, and Conclusions



1. Draw or describe the pattern you observed through each diffraction screen the first time you looked at the light source.
2. How did the pattern change as each diffraction screen was slowly rotated?

Junior Home Scientist



You can observe the same square aperture diffraction pattern using a point source of light at home. Find a window with sheer curtains and observe a street light through the curtains. This experiment will need to be done at night when the street light is lit. To observe the diffraction pattern, turn the room light off and look at the street light through the sheer curtain. The street light serves as the light point source and the curtain provides the diffraction screen.