Basic laser experiment

by U.S. BUREAU OF RADIOLOGICAL HEALTH

Reflection of light is explored with the aid of the laser

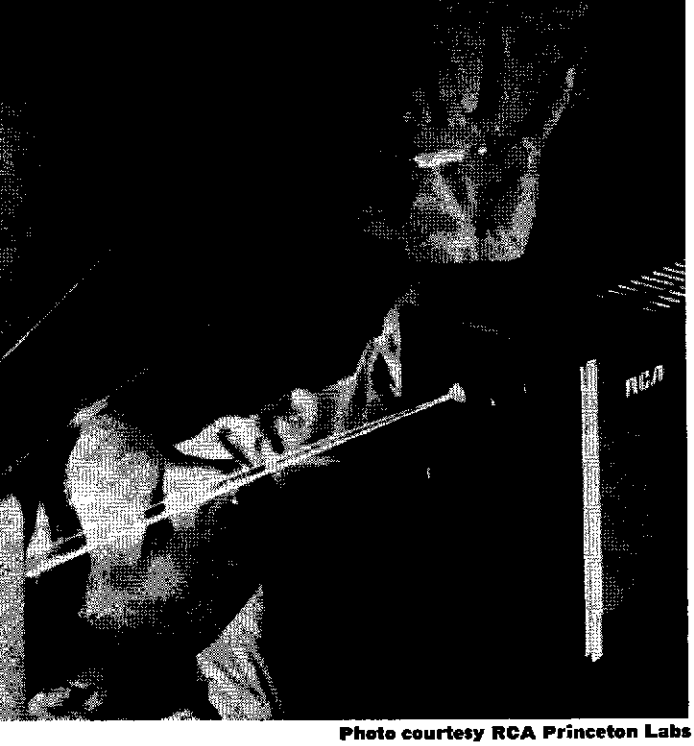

Photo courtesy RCA Princeton Labs

Explanation:

Light and the manner in which it is reflected are of prime importance in geometrical optics. There are two types of reflection: (1) diffuse reflection, in which light striking a rough surface is randomly scattered in many directions, and (2) specular (i.e. mirror-like) reflection, in which the incident light is reflected from a smooth surface in accordance with the law of reflection (i.e., the angle of incidence equals the angle of reflection, as shown in Fig. 1). As discussed in most physics

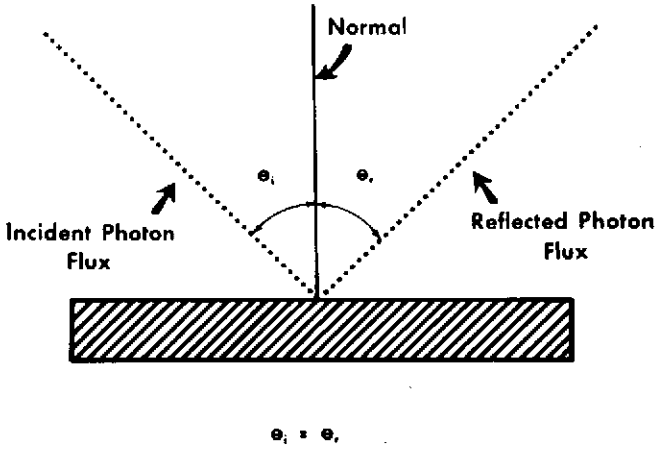

Fig. 1 **LAW OF REFLECTION**

texts, the behavior of light at an interface between two media is governed by both the law of reflection and the law of refraction.

Materials:

Laser
Display tank and display fluid
Support for tank
Mirror on pivot mount
White paper
Protractor

Experimental procedure:

Arrange the experiment as shown in Fig. 2 with the display tank near the laser and a mirror on a pivot mount arranged to reflect the beam back into the tank. Note that near the mirror the reflected beam has approximately the same intensity as the incident beam. You might, however, see a loss of intensity as the incident and reflected beams traverse the fluid. This is due to scattering of the beam by the fluid molecules, the process which makes the beam visible from the side.

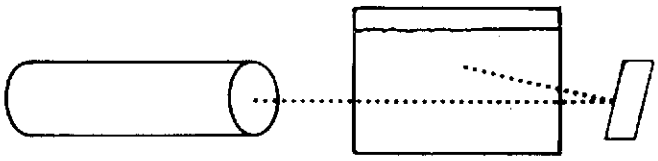

Fig. 2

SPECULAR AND DIFFUSE REFLECTION SETUP

Hold a piece of white paper in front of the mirror. The light will now be diffusely reflected and no beam will be seen re-entering the display tank. The point at which the light strikes the paper will be visible through a wide angle, because of this diffuse reflection. When the paper is removed, the reflected beam will again be visible in the display tank. The point at which the laser beam strikes the mirror will not be readily apparent from the side since the light is being specularly reflected. Whatever light is seen from the side is caused by diffuse reflection from small random mirror imperfections and to scattering of dust on the mirror surface.

The second part of this experiment illustrates the Law of Reflection which shows that the angle of reflection always equals the angle of incidence. Arrange the apparatus as shown

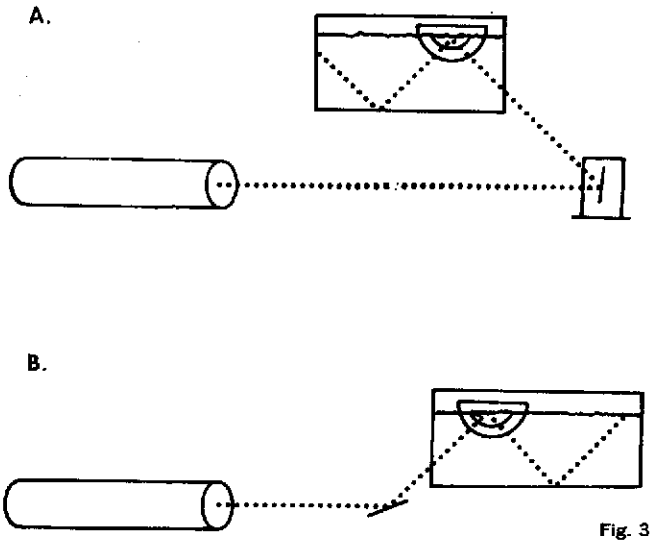

Fig. 3

in Fig. 3-a or Fig. 3-b so the laser beam enters the tank and is reflected off the upper surface of the display fluid. Using the surface of the fluid as a reference, measure the angles of incidence and reflection with a protractor. Now change the angle of incidence and measure angles again. At some angle termed the critical angle, the light will not be reflected. **R-E**