LIGHT

Introduction

The lecture demonstrations listed in this section also include a short description and outline of how the demonstration experiment works. This is for the benefit of the lecturer (who is going to use it in the classroom) and the student (who will see it demonstrated in class).

[To the lecturer:

All of the equipment used in these demonstrations is stored in Heldenfels Hall. Some of the equipment is rather delicate and not easily transported to other buildings (our only mode of transport is a cart pushed by hand).

When requesting a demonstration, be sure to mention the reference number and name listed in this section (example MEC-1 Friction). Requests for demonstrations to be set up in a different building from Heldenfels will require at least 3 class days notice. The logistics of setting up demonstrations in different buildings gets difficult without advance notice.

Practice with the apparatus prior to use in the classroom is always encouraged.]

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L-1    DISPERSION OF LIGHT BY A PRISM

*Equipment:*  Mounted prism  
White light source (with no lens)

*Comments:* Shine the light source on the prism and adjust the light source such that a spectrum of colors is displayed on the wall or screen.
L-2 LIGHT RAYS THROUGH LENSES AND PRISMS

Equipment: Ray tracing apparatus (light and adaptor)
           Lenses and prisms mounted on apparatus

Comments: Attach the lens or prisms on the metal screen (with the mounted magnets).
          The light source may be adjusted for a single light ray or multiple light rays.
L-3 IMAGE FORMATION WITH LENSES

Equipment: Optical bench containing a lamp, converging lens, diverging lens and a frosted glass plate

Comments: Plug the lamp into the wall outlet and adjust the distance between the lens and the lamp to form an image on the frosted glass plate. Is it upside down? Focal length and magnification of a lens may be shown.
L-4  FIBER OPTIC

Equipment:  Clear curved lucite rod
             Laser and stand

Comments: The total internal refraction of the lucite rod may be shown. DO NOT SHINE THE LASER LIGHT AT THE CLASS.
FINDING SLIT SEPARATION ON DIFFRACTION GRATING
AND
FINDING WIRE (HAIR) WIDTH (L-5)

(Equipment: Laser on stand, slide holder/stand, meter stick, diffraction grating and wire on slide)

To find the slit-to-slit separation of a diffraction grating, a laser is placed on the lecture table and aimed through the diffraction grating in the slide mount. A diffraction pattern (multiple horizontal dots some distance apart) should appear on the screen. By measuring the distance between the diffraction grating and the screen ($D$), the distance between the central beam and the first dot on the wall ($x$, first order), and knowing the wavelength of the helium-neon gas laser $\lambda$ ($632\times10^{-7}$ mm), the slit-to-slit separation of the diffraction grating ($d_s$) may be determined.

$$d_s = \frac{\lambda}{\sin^{-1}(x/D)}$$

To find the width of a wire, shine the laser at the wire so that when the wire is illuminated, a diffraction pattern appears on the screen. As in the first part of this experiment, the distance between the wire mount and the image on the screen ($D$) and the distance between the patterns ($X$) will be measured. It may be helpful to use a blank sheet of paper when marking the distance between the patterns.

Using the distance ($X$), the laser wavelength $\lambda$ ($632\times10^{-7}$ mm), and the distance between the wire and the screen ($D$), the width of the wire ($d_{wire}$) may be determined.

$$d_{wire} = \frac{\lambda}{\sin^{-1}(x/D)}$$
L-6 DIFFRACTION GRATINGS AND CORNELL SLIDES

Equipment: Gas discharge tubes and supports (2 ea)
           Variac
           Incandescent lamp on base
           Diffraction gratings (specify number)
           Cornell slides (specify number)
           Cornell slide pattern board

Comments: Plug the incandescent bulb in to the Variac. Adjust the Variac output until the tube glows to a comfortable brightness. The cornell slides and diffraction gratings may be distributed to the students (to observe the prominent lines of the light sources) but be sure that all the materials are returned.
L-7 POLARIZATION OF LIGHT

Equipment: Polaroid sheets (2)  
Plastic protractor  
Transparency sheet with “magic” tape  
Overhead projector

Comments: Place the polaroid sheets on the overhead projector and rotate one of the sheets. Note the polarization effect. Put the transparency sheet (with the magic tape) between the polaroid sheets. Rotate one of the polaroid sheets (to show how the light through the magic tape is effected). Put the protractor between the polaroid sheets and slightly flex the protractor. This will show the stresses in the plastic (but be careful not to break the plastic).
L-8  POLARIZATION OF MICROWAVES

*Equipment:* Microwave transmitter and receiver assembly
Metal grid plate
Aluminum plate
Wood-fiber plate

*Comments:* On the transmitter unit, set the transmitter klystron voltage control to mid-range and the oscillator switch to internal position. On the receiver unit, adjust the receiver gain control to mid-range. The horns of the two units should be aimed at each other and about 12 inches apart. Turn on the two units and adjust the speaker volume control to a suitable level. Rotate the receiver horn (should be removed from the receiver unit) to show polarization and reflection.