Lab 6: Lenses, Mirrors, and Telescopes
Phys223 - Thursday (Ellis Roe)

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Purpose

In this lab, we examine what happens to rays of light when directed in to various mirrors and lenses. We start by looking at simple reflection off of a mirror, then determine the focal length of both convex and concave lenses. Next, we observe the change in size of an object when magnified through a lens. Finally, we build a telescope using two lenses called the ojective and the eyepiece.

Procedure

Exercise I

Using a single incident ray from a light source, we measure the incident and reflected angle whe directed at a flat mirror. We then repeat the measurements using the primary color rays generated by the light source.

Using a concave mirror and five parallel light rays, we determine the focal length by measuring the distance from the intersection of the five rays to the center of the mirror. Then, with a compass we determine the radius of curvature of the mirror and compare. Finally, we do the same with a convex mirror.

Exercise II

In this exercise, we investigate the difference between concave and convex lenses in terms of focal length. Again using the five incident light rays, we measure the focal length of each type of mirror individually. Next, we nest them together to produce a single lens and measure the focal length of that. Finally, we slide the lenses apart to see the effect of light traveling through the two lenses separately at different places.

Exercise III

We use a 200mm lens to focus the light source of a tree outside the building on to a screen. When we are able to focus the image, we measure the distance from the lens and the screen: the image distance. We repeat with a curved mirror to see the image in front of the mirror.

Next we set up a lens and screen on the optical bench where we can shine an image from a light source through the lens and on to the screen. We then determine a lens position for which the image is in focus on the screen and measure the size of the image. Moving the screen along the bench, and finding the two positions of focus, we create a table of image size and lens distance for each screen position we choose. Later, we plot these points and calculate the magnification due to the lens.

Application: Telescope

In this last section of the lab, we build a telescope using the provided materials and instructions. Before assembling the telescope, we measure the focal length of the eyepiece and the objective lens. We later use these to determine the magnification of the telescope. Through the telescope, we compare the image size and object size of a distant poster which has a series of vertical lines running down it.

Data

Analysis

Conclusion