Lenses

Equipment

- Light boxes with power supply and various optics
- Optical bench, with assorted mounts and optics (pinhole and lenses)

Objective

Physics Concepts

- Lensmaker's Formula and Gaussian Lens Equation

Experimental analysis

- Fit curves to data to determine mathematical relationships
- Recognizing the uncertainty in measurements

Conceptual (C-Level)

Explore image formation and refractive lenses.

Trace the rays to determine the image location for an object in the following situations:

- Converging lens – object outside the focal point
- Converging lens – object inside the focal point

How would your ray tracing change if the lens material had a smaller index of refraction than the medium in which it was placed? (for instance, an air lens placed in water)

EXPLORATIONS:

- Can you form an image of an object on the screen just using a pinhole?
- Grab a spoon and note how your image changes depending on what side you are looking at and how close you are from the spoon.
- Form an image of an object on a screen with a lens. What happens to the image when you cover the top half of the lens?

Basic Lab (B-Level)

Using a lens with a long focal length (f>40cm) and a lens with a short focal length (f<15cm) construct a refracting telescope.

- Describe the method used to determine the focal length of the lenses. Report their respective focal lengths.
- Draw a schematic of your telescope setup.
- Determine the experimental magnification and compare with the theoretical magnification.

Advanced/Extended Lab Ideas (A-Level)

- Explore (theoretically and/or experimentally) other types of telescopes.
- Explore the physics of the eye.
- Construct a classic optical illusion. (For example, Figure P87 in Chapter 24 of, **Physics: Calculus** 2nd Edition, by Hecht, volume 2 page 992)
- Investigate a topic of your choosing.