# Measuring Paraxial Properties of Lenses II

**Background:** Section 1.4 of the OPTI 515 Course Notes

**Introduction:** The laboratory continues to explore different methods of measuring the first order properties of lenses and optical systems.

1. **Focal Length of a Thin Lens** – Set up an object and a thin lens. Find the location of the image. Measure the object and image distances. Use the Gaussian imaging equation to determine the focal length of the thin lens. What is the object distance where it can be assumed that the object is at infinity, if we only need to know the lens focal length to within 10%?

2. **Autocollimation Technique** – Set up the laser and microscope objective to create a point source as shown in figure 1-1of Wyant's notes. Place a small aperture at the location of the focus. Next, add the copy lens to the path and finally a plane mirror. Adjust the position of the copy lens until the retroreflected light comes to focus on the aperture. NOTE: you will need a small tilt in the mirror so the return light doesn't pass back through the aperture. The focal point of the copy lens will lie at the aperture stop. Measure the front focal distance. How does this compare to the measurements obtained with the nodal slide in Lab 1? Reverse the orientation of the copy lens and repeat for the rear focal point.

3. **Reciprocal Magnification** – Using the copy lens, set up an object and measure the magnification, m, of the system. Keeping the object and image planes fixed, slide the copy lens until the object is reimaged onto the image plane with a magnification of 1/m. How far did the lens need to be moved? Calculate the object and image distances based on the magnification and the distance moved. Determine the focal length and location of the principal planes of the copy lens based on these results. How do these results compare to the results obtained with the nodal slide in Lab 1? In terms of complexity, which technique, nodal slide or reciprocal magnification, was easier to implement?

4. **Neutralization Test** – Hold an unknown thin lens about 100 mm above a vertical line. Does the line appear larger or smaller within the aperture of the lens. If the lens is moved to the left, which way does the line appear to move within the aperture of the lens. Repeat this process for the other unknown lens. From the trial lens kit, select a lens that cancels and magnification and motion effects when placed in contact with the unknown lens. What are the powers of the two unknown lenses?