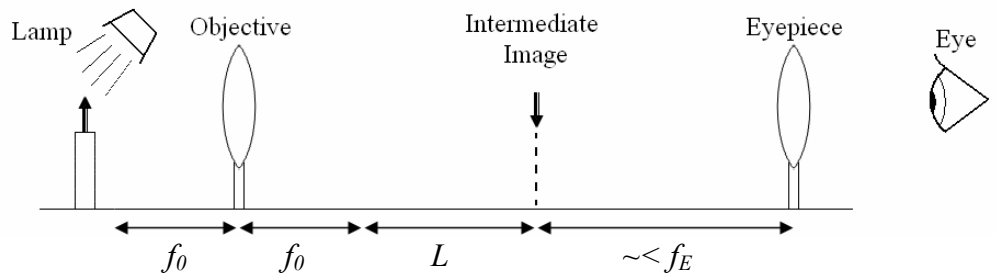
Experiment 4: Microscope Phys 431

In this experiment you will build a reflection microscope and use it to look at a small character printed on a piece of paper. In this way, you will be able to examine the sharpness of the lines drawn by our printer. The simple instrument will consist of two positive lenses: (1) an objective lens that faces the object and produces an inverted intermediate image, (2) an eyepiece that works like a simple magnifying glass, further magnifying the intermediate image.

Procedure:

A. Measure the focal lengths of your objective lens and eyepiece and then set up the following system.



B. In the sketch above, the object is 1.25 f_o away from the objective lens. Draw a ray diagram for this case. Next draw a ray diagram for an object distance of 1.75 f_o, adjusting the placement of the eyepiece accordingly. **Q1** Is the magnification greater or less for the 1.75 f_o distance?

C. Set the object distance to about 1.5 f_o and focus the microscope. **Q2** Can you obtain a better image by reducing the magnification? If so, how can you explain this? You should find that the border of the field of view is fairly well defined. This may seem surprising; remember that for the periscope we needed to use a field stop to obtain a sharp border. **Q3** Why is this not necessary in this case?

D. Situate the camera in the place of your eye to take a picture, taking care to get the image in focus (feel free to adjust the position of the eyepiece if necessary). Please included the picture in your write-up. Now that the character is greatly enlarged, you can comment on the precision of our printer. Note that the lines and curves do not look perfectly sharp. **Q4** Are the imperfections consistent with the printer's resolution of 1600 dots per inch? If not, please speculate as to the origin of the less-than-ideal characters.

E. Calculate the angular magnification for your system in the configuration used to take the picture. Use the formula from your text,

$$M = -\left(\frac{25}{f_e}\right)\left(\frac{L}{f_o}\right),$$

where L is the distance between the intermediate image and the second focal point of the objective lens.