PHGN 480 Laser Physics Lab 7: HeNe power and mode optimization

Do this by the end of the day Monday, 28 November. Turn in your write-up in class on the following Tuesday.

For this lab, you finish the alignment process for building a HeNe laser. There are 5 laser tubes, but only 3 of these will have a high-reflector mirror bonded to one end of the tube. These 3 are much easier to align, so your team should pick one of them. We will work later on creating resonators from scratch with two independent mirrors.

The goals of this lab are to:1. Align the single-window laser tube to obtain lasing (see lab 4).2. Vary the cavity length and make several observations of mode structure and output power at each position.

Follow the procedure for Lab 4 to align the laser tube to the reference beam and to get the cavity to lase. Before installing the laser tube, verify that the beam is level to the table and straight to the table holes. You will be moving the output coupler back and forth, so if the optical axis of the laser is level, it will be much easier to maintain or restart lasing as the OC is moved.

As the output coupler mirror is detuned from optimum power, you should notice the laser can run in higher-order modes. Use the camera to take a picture of one or two of them, and save them for your report.

As the cavity length is varied, the beam size at both mirrors in the resonator changes. When the beam is much smaller than the capillary tube that confines the discharge, the laser can support several higher order modes. These higher-order modes can be suppressed by introducing an iris inside the cavity. **Try getting the laser to run in the lowest order mode by centering the iris on the beam and gradually making the opening smaller, all the while looking at the profile.** Record the output power for **multimode and single-mode operation for several cavity lengths. Try to find the cavity length that gives the optimum power with a Gaussian output beam.**