

Preliminary Draft of The Speed of Light Experiment (4-18-2007)

Note to student: This is a new experiment which we would like to see improved for PHY344 students. We welcome suggestions for improvement.

For the most part you may just follow the instructions in the PASCO Manual.

EYE HAZARD: Warning. Because of the possibility of looking directly at the laser light you have to be careful not to do so. Normally one will simply avert one's eyes, but in the case of deliberately looking at a laser image one does not necessarily avert one's eyes. The instruction is to put two polarizers in a nearly crossed orientation before looking at the beam. You must do this. Only when the mirror is rapidly rotating are you permitted to view the laser directly. If you go back to looking at the laser image without the mirror rotating you must **always** remember to reinsert the almost crossed polarizers!!!!!!!!!!

The Foucault Method for measurement of the speed of light is detailed on pages 3 to 5 of the manual.

The main challenge of the experiment is the alignment. We have set the apparatus reasonably close to the correct alignment.

There are some changes relative to the manual. (Read the manual and then reread the following before you start.) Many things are suggested recipe like with no explanation, so it is important to discover why they are suggested. For example it says mount the microscope with the micrometer on the same side as the meter scale and another place it says away from where the beam traverses. As you will discover, neither suggestion is right. The secret to success is to visualize precisely what the optics is doing and then you will not make any mistakes.

The laser is not attached on an exterior mount. Instead a laser sits on the bench. Hence the numbers given for the position of the lenses and the measuring microscope have to be changed.

The measuring microscope has to be mounted so that when the lever is pointed down the mirror reflects the beam from the rotating mirror up into the microscope part.

Ultimately L_2 lens has to be focused so don't worry about a position of "62.2 cm". It is focused so that the laser spot is a minimum at the mirror that is about 15 meters distant. Note that by using a reflector on the wall, the final mirror is actually on the same table as the laser and rotating mirror. The light from the Rotating Mirror goes to the far wall back to the final mirror on the table, back to the wall and then returns to the Rotating Mirror. This has the advantage of increasing the accuracy of the measurement with the longer path for the light to travel and making adjustment of the final mirror immediately accessible to the student at the optical bench. Without this approach two students would be needed to do the experiment.

Step 9 says to be sure the axis of rotation of the Rotating Mirror is vertical. Rather than using the tedious paper shim approach, the "optical bench" should be leveled to bring this about. You know you are level when as you rotate the beam with hand movement of the Rotating Mirror the

beam stays at the same height from the bench. It doesn't have to be perfect, but the beam does go about 15 meters before it returns precisely to the rotating mirror so it has to be pretty good.

Relative to the Alignment Hints page 13 of PASCO Instructions

When you are looking for the spot reflected back to the microscope from fixed mirror it is important to follow their suggestion to check for the spot by "Blocking and unblocking the beam path between the rotating mirror and the fixed mirror and watching to see what disappears."