

Faraday Rotation - Pre-lab exercise

You can use the lab report template to prepare the submission of the pre-lab exercises. Feel free to use calculations or graphs in your final report, but you don't need to include prelab with the report.

1. Check you understanding of polarized light

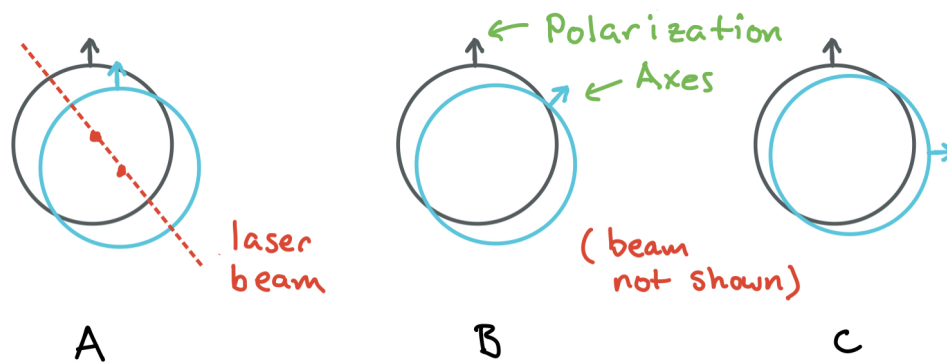


Figure 1: Different combinations of polarizers.

In the figure 1 a laser beam is passing through two polarizers. Their polarization axes are shown as arrows. For each case, how much of the initial intensity of the beam, I_0 , is still present after it has passed through both polarizers? You should estimate the rather common angles that are shown. Answer for each case by stating your estimated angle and also the numerical value of the intensity, assuming $I_0 = 1.0$.

2. Estimation of the expected Faraday rotation

Using Eq.(2) roughly estimate the value of the expected rotation angle for $B \approx 10$ mT. Check on-line sources to find a reasonable value for C_V for glass.

3. Optimization of the measurement settings

Examine Eq.(4) to find the value of the angle θ that will provide maximum useful signal for measuring ϕ .

Hint 1: Every time I hear maximum or minimum, I think about derivatives.

Hint 2: If you are having trouble, try this: for each of the angles in question 1 compute the numerical value of the two terms in equation 4, assuming $I_0 = 1.0$, and your value of ϕ from part 2. Is the intensity I in equation 4 sensitive to the value of ϕ for each of those angles? Compute for other angles of your choice. How do we adjust θ to maximize the useful signal?

4. The source of polarization

The previous questions assumed that there are two polarizers in the system. But, figure 2 in the manual shows only one. This experiment cannot work with just one polarizer. So, where is the other one?

Hint: read the lab manual carefully.