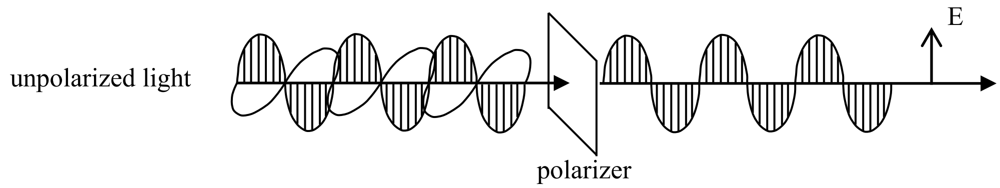
Experiment 5: Polarization Phys 431

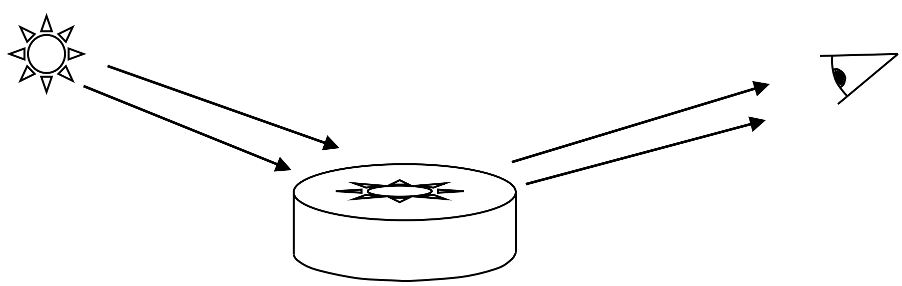
This lab could be called "fun with polarization". (At least we hope you feel that way at the end.) The lab is divided into three parts, all of which employ polarized sheets; see below. You will have to determine how to do many aspects of the experiments. All of the data acquisition will be done with your eyes, with no photographs required. Please take detailed notes, because much of the data will be qualitative. The write-ups should explain how each part was performed.



Procedure:

A. Determine if the light reflected at grazing incidence from a glass plate is polarized (see below).

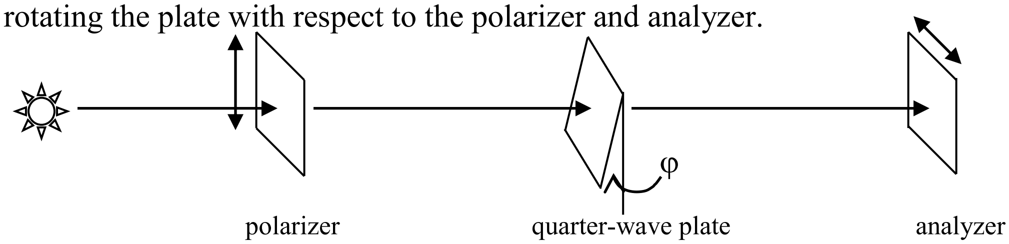
   Q1 If so, what determines the polarization direction?
   Q2 Imagine the glass plate was a road in the late afternoon. What orientation would you want your polarizing sunglasses to be?



B. You have a laser with a polarizer added to it and a "detector" at the other end of the optical bench. You need to mark the direction of polarization on the laser, by finding where extinction [no light coming through] occurs.

C. A quarter-wave plate is an optical element that introduces a relative phase shift of $\pi/2$ between orthogonal components of an incident wave. The reason this happens is that one component moves across the plate more rapidly than the other. It should be apparent that linear light incident parallel to either principal axis will be phase shifted, but otherwise unaffected. You can't have a relative phase difference without having two components.

Using the following set-up, determine the optical axis of a quarter-wave plate by rotating the plate with respect to the polarizer and analyzer.



Q3 At what angle ϕ_0 do you expect to observe the least intensity?

Rotate the plate by 45° with respect to ϕ_0.

Q4 Do you expect this to be an intensity maximum? Why?

Q5 With the plate fixed at this orientation, what happens if you rotate the analyzer? Can you explain this?