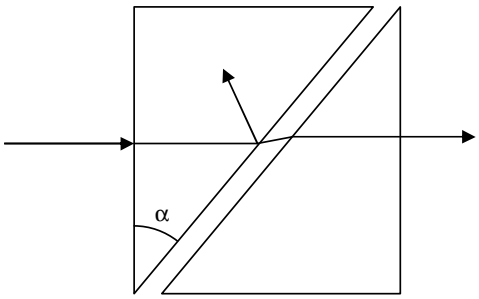
Phys 531 Assignment 13 Due December 5

1. A Glan-Laser polarizer is constructed as shown below. The two prisms are calcite ($n_o = 1.66$ and $n_e = 1.49$), with their optic axes perpendicular to the plane of the figure. The prism angle α is chosen so that one polarization state is totally internally reflected when exiting the first prism, while the other polarization state is transmitted. The second prism ensures that the output beam emerges parallel to the input beam. (The gap between the prisms is large enough to avoid coupling to the evanescent wave of the reflected light.) Assume the incident light is normal to the input face.
(a) Find the range of angles α that allows the polarizer to function as described, and identify which polarization state (TE or TM) is transmitted.
(b) Use the Fresnel equations to calculate the total transmittance of the device (for the transmitted polarization). Assume α is in the middle of the range you found in part (a). You can ignore any interference effects due to multiple reflections.



2. Suppose an random optical wave is described by a complex wave function

$$U = \sum_{n=1}^{N} a_n \exp(i2\pi\nu_n t)$$

where the coefficients a_n are random variables satisfying $\langle a_n^* a_m \rangle = 0$ if $n \neq m$ and $\langle a_n^* a_n \rangle = A_n$. Calculate the temporal coherence function $G(\tau)$ and the power spectral density $S(\nu)$. Express your answer for S in terms of delta functions, with

$$\delta(\nu - \nu_0) \equiv \int_{-\infty}^{\infty} \exp[2\pi(\nu - \nu_0)t]\, dt.$$

3. Saleh and Teich Problem 10.1-3, page 381. You might find it useful to read through example 10.1-1 on page 353.

4. Saleh and Teich Problem 10.1-6, page 381.

5. Saleh and Teich Problem 10.2-2, page 382. Note that the wavelength emitted by a sodium lamp is 590 nm.