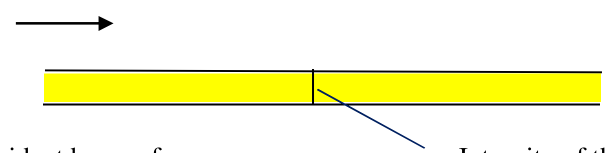
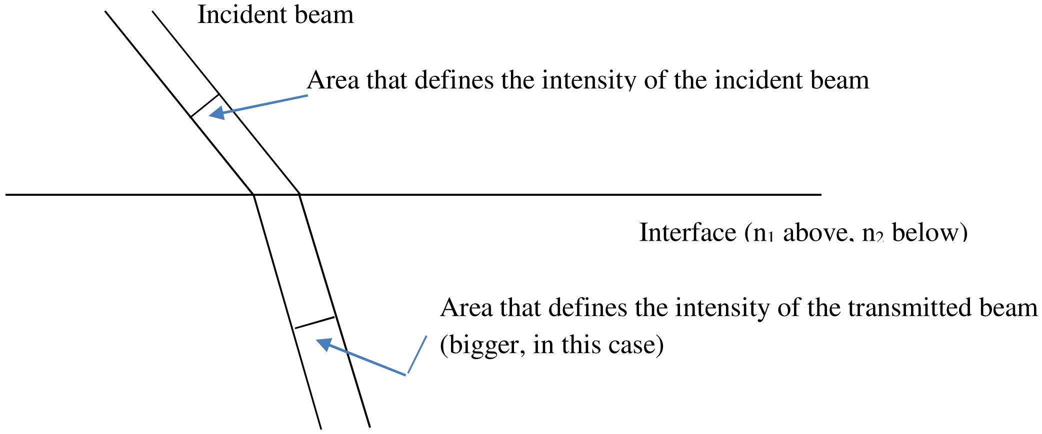
PHGN 462 Homework 5 – Due Friday Oct. 11th

1) Pollack and Stump 13.12. We're starting from a Fourier-domain representation of a wavepulse with a Gaussian envelope. Then we do the Fourier transform to get back to position space, using a bit of math hax in the process to give us an equation that lets us derive the expressions for group and phase velocities. Keep in mind that you can find a velocity by tracking a particular value of the argument of a function.

2) Non-normal incidence has one other tiny little complication we haven't talked about yet. So far we've been using the definitions $R = \frac{I_R^2}{I_I^2}$ and $T = \frac{I_T^2}{I_I^2}$, and power conservation has required that $\frac{I_R^2}{I_I^2} + \frac{I_T^2}{I_I^2} = 1$. But if you use the Fresnel equations to generate those intensities in the general, non-normal case, they don't add up to 1. That's bad. Power is still conserved in non-normal incidence problems. The issue is that intensity as we've defined it is power per unit area *assuming normal incidence*:



When light is incident on a surface at some angle, we still define intensity in the same way, but the width of a particular slice of wave *changes* as we go from incident to transmitted:



a) In order to preserve the core principle that power in equals power out, we need to use geometry to generalize the equation $\frac{I_R^2}{I_I^2} + \frac{I_T^2}{I_I^2} = 1.$ Figure out how. You're going to need to add some trig factors here and there.

b) Using the above, show r + t = 1, where r and t are the new versions of R and T that properly respect the geometry of the non-normal case. To keep it simple, just do the TE case, and let $n_1 = 1$.

3) Peer lecture, as discussed elsewhere. Focus on timing and structure.