Homework 11 due 29 Nov. 2006 5 pm
PH462 EM Waves and Optical Physics posted: 18 Nov. 2005

1) Figure 11-9a shows a schematic of a Fresnel mirror setup for interferometry.
   a. Assuming a slit source and an angle α between the mirrors that is small, calculate the interference pattern (intensity) as a function of position on the screen. Describe the effect on the pattern as α is adjusted.
   b. What advantage does this arrangement have over the traditional double slit experiment in observing fringes from a white light source such as the sun?

2) When we use a spectrometer, our signal (the spectrum, or more precisely, the spectral intensity) is proportional to $|E_{in}(\omega)|^2$, where $|E_{in}(\omega)|^2$. Consider two pulses of light entering a spectrometer with a time delay τ. In this case we see interference of the two pulses in the spectrum. (This is the starting point for the field of spectral interferometry.)
   a. Calculate the measured spectrum in the case where the pulses have a rectangular shape (see the definition of the rect function on the transform sheet:
   $$E_{in}(t) = E_1 rect\left(\frac{t}{t_0}\right)e^{-i\omega_0 t} + E_2 rect\left(\frac{t-\tau}{t_0}\right)e^{-i\omega_0(t-\tau)}$$
   b. Letting $E_1 = E_2$, make a plot of the spectrum for two different time delays, showing the variation in the fringe spacing with delay. Determine how to calculate the time delay by measuring the spectral separation of the fringes.
   c. If the *energy* in the second pulse is 1% of the energy of the first pulse, what is the visibility of the fringes?