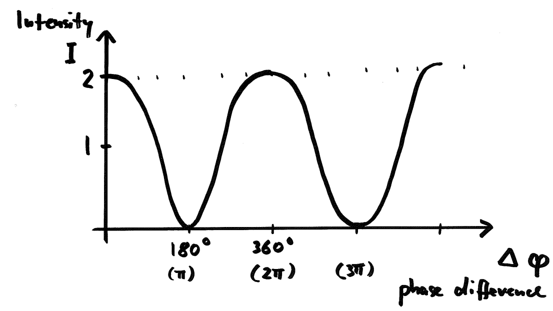
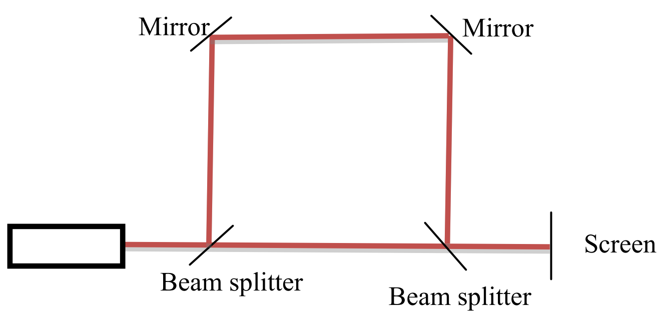
Prelab for Lab 1: Wave Optics and Interferometry **Physics 15c, Spring 2015**

To answer these questions, you'll need to refer to the lab write up, which is posted on the course website.

1. Read the section on "Interference". The intensity of two interfering light waves of intensity I_0 is $I = 2I_0 \cos^2\left(\frac{\Delta\phi}{2}\right)$ (see figure at right). By how much do you have to shift the relative phase $\Delta\varphi$ between the two waves such that you go from an interference maximum to the next interference minimum?



2. Consider the system shown in the figure below. A beam splitter is essentially a semi-transparent mirror. Some of the light is reflected, and some passes through.



In the previous question, you calculated the phase difference between two waves needed to go from constructive to deconstructive interference. Now we'll see why this is useful for measuring very small distances.

a) What is the equation for the phase difference (at a given measurement plane) between two collinear waves having a common phase at the output of the laser, but having traveled different distances to the measurement plane (call these distances x_1 and x_2)? Assume the laser has a wavelength λ and the beams are traveling in a medium of refractive index n.

b) Let $|x_1 - x_2| = \Delta x$. What change in Δx do you need to go from light to dark (from the phase difference you calculated in Q1)?

c) How can we make these small adjustments in our interferometer system?