

58. Let the position of the mirror measured from the point at which  $d_1 = d_2$  be  $x$ . We assume the beam-splitting mechanism is such that the two waves interfere constructively for  $x = 0$  (with some beam-splitters, this would not be the case). We can adapt Eq. 36-22 to this situation by incorporating a factor of 2 (since the interferometer utilizes directly reflected light in contrast to the double-slit experiment) and eliminating the  $\sin \theta$  factor. Thus, the phase difference between the two light paths is  $\Delta\phi = 2(2\pi x/\lambda) = 4\pi x/\lambda$ . Then from Eq. 36-21 (writing  $4I_0$  as  $I_m$ ) we find

$$I = I_m \cos^2 \left( \frac{\Delta\phi}{2} \right) = I_m \cos^2 \left( \frac{2\pi x}{\lambda} \right) .$$