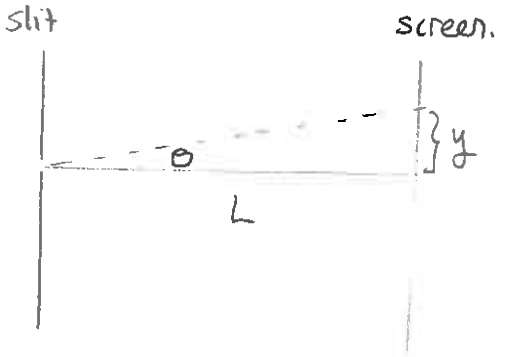
Phys 473 2015

HW due Weds

Lecture 36

Single slit diffraction

For a single slit of width b, the intensity of light with wavelength λ is:



$$I(\theta) = I(0)\left[\frac{\sin\beta}{\beta}\right]^2$$

where

$$\beta = \frac{kb}{2}\sin\theta = \frac{\cancel{2}\pi b}{\cancel{\lambda}}\sin\theta$$

If the angles are small then $y/L = \tan\theta \approx \sin\theta$. Thus we expect

$$I(y) = I(0)\left[\frac{\sin\beta}{\beta}\right]^2$$

where $$\beta = \frac{\pi b}{\lambda}\frac{y}{L}$$

Double slit diffraction

For a double slit with slit spacing d and width b

$$I(\theta) = I(0)\left[\frac{\sin\beta}{\beta}\right]^2\left[\cos\gamma\right]^2$$

using $\gamma = \frac{kd}{2}\sin\theta$ and β as before. Here

$$\gamma = \frac{\pi d}{\lambda}\frac{y}{L}$$

Exercise Using the PASCO RMS - linear optics translator
- photodiode detector

plot $I(\theta)$ vs θ

a) Single slit with various slit widths

b) double slit with various widths.

c) Get λ from one of the double slit patterns, using the given slit spacing.

d) Use the result of c) to plot $I(\theta)$ vs θ for given slit widths + spacings. Compare to data..