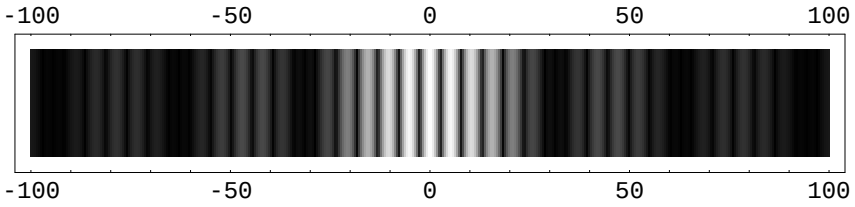
4. (30 pts.) Monochromatic light falls on a pair of slits. Each slit is 3.5×10^{-2} mm wide. The pattern shown in the figure below is observed on a screen 2m away. The markings on the figure are in mm.

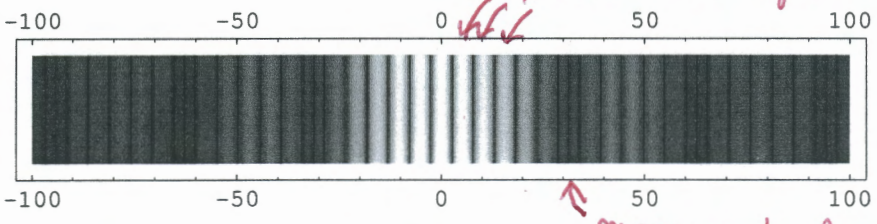


a. (15 pts.) What is the wavelength of the light?

b. (15 pts.) What is the center-to-center spacing of the slits?

4. (30 pts.) Monochromatic light falls on a pair of slits. Each slit is 3.5×10^{-2} mm wide. The pattern shown in the figure below is observed on a screen 2m away. The markings on the figure are in mm.

measure these for d



measure to here for a.

a. (15 pts.) What is the wavelength of the light?

$a = 0.035\,m$ $\quad L = 2{,}000\,mm$

$a\sin\theta = m\lambda \qquad m = 1$

$\sin\theta \approx \frac{y}{L} \approx \frac{32}{2000} = 0.016$ ~~radians~~.

~~$a = 1$~~ $\quad \lambda = \frac{a\sin\theta}{1} = \frac{(0.035)(0.016)}{1}$

$\lambda = 5.6\times10^{-4}\,mm = \boxed{560\,nm}$

(b) $d\sin\theta = m\lambda$

Way #1: $m = 4$ is about at $y = 20\,mm$, $\sin\theta \approx y/L$

$\therefore d = \frac{4\lambda}{20/2000} \approx \boxed{0.224\,mm.}$

Way #2: 6th order is missing.

$\therefore \sin\theta = \frac{n\lambda}{a} = \frac{m\lambda}{d}$

$\frac{1\lambda}{a} = \frac{6\lambda}{d}$

$\boxed{d = 6a = 0.21\,mm}$

either estimate is reasonable given the data. ($d = 0.21$ was used to generate the image.)

b. (15 pts.) What is the center-to-center spacing of the slits?