

PHY250: Single Slit diffraction

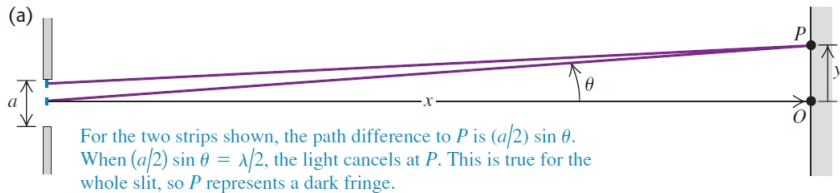
Anabela R. Turlione

Digipen

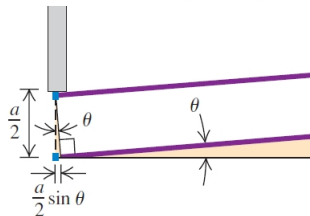
Fall 2021

Let us calculate the wavelength of a laser

Position of dark fringes in a single slit of width a



(b) Enlarged view of the top half of the slit



θ is usually very small, so we can use the approximations $\sin \theta = \theta$ and $\tan \theta = \theta$.
Then the condition for a dark band is

$$y_m = x \frac{m\lambda}{a}$$

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for small angles:

$$\frac{y_m}{x} = \frac{m\lambda}{a}$$

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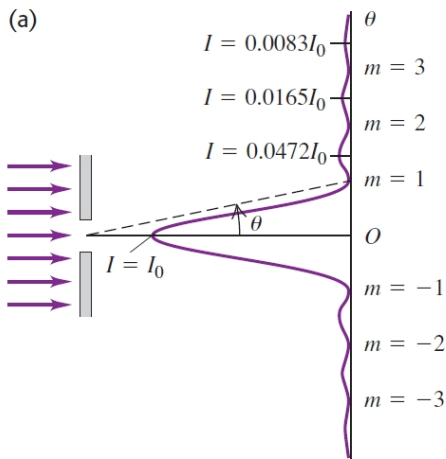
$$\sin \theta = \frac{m\lambda}{a} \quad (m = \pm 1, \pm 2, \pm 3, \dots) \quad (\text{dark fringes in single-slit diffraction})$$

for small angles:

$$\frac{y_m}{x} = \frac{m\lambda}{a} \rightarrow y_m = x \frac{m\lambda}{a}$$

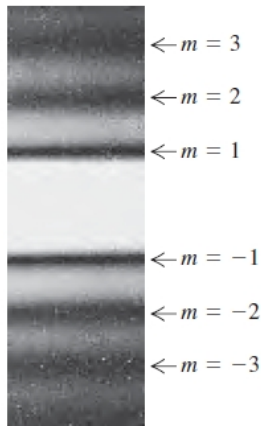
Intensity of the pattern

Position of dark fringes in a single slit of width a



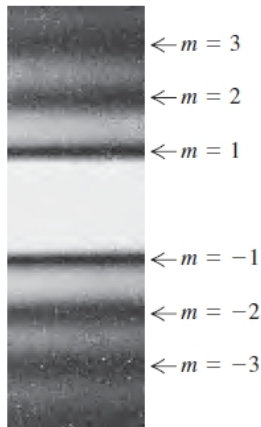
What we observe is something like this

Position of dark fringes in a single slit of width a



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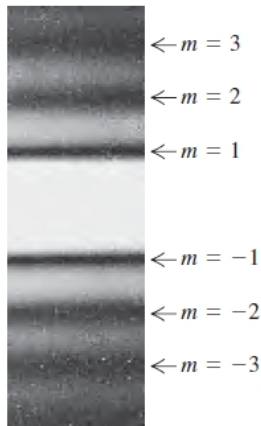
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Then, if we know the position of the first dark fringe, the width of the slit and the distance to the screen, we can calculate λ for a given source:

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Position of dark fringes in a single slit of width a



Then, if we know the position of the first dark fringe, the width of the slit and the distance to the screen, we can calculate λ for a given source:

$$\lambda = \frac{ay_m}{xm}$$