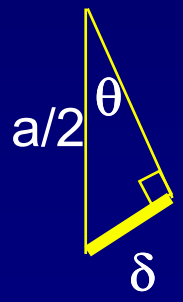
Single-Slit Diffraction

Slit of width a. Where are the *minima*?

Use Huygens' principle: treat each point across the opening of the slit as a wave source.

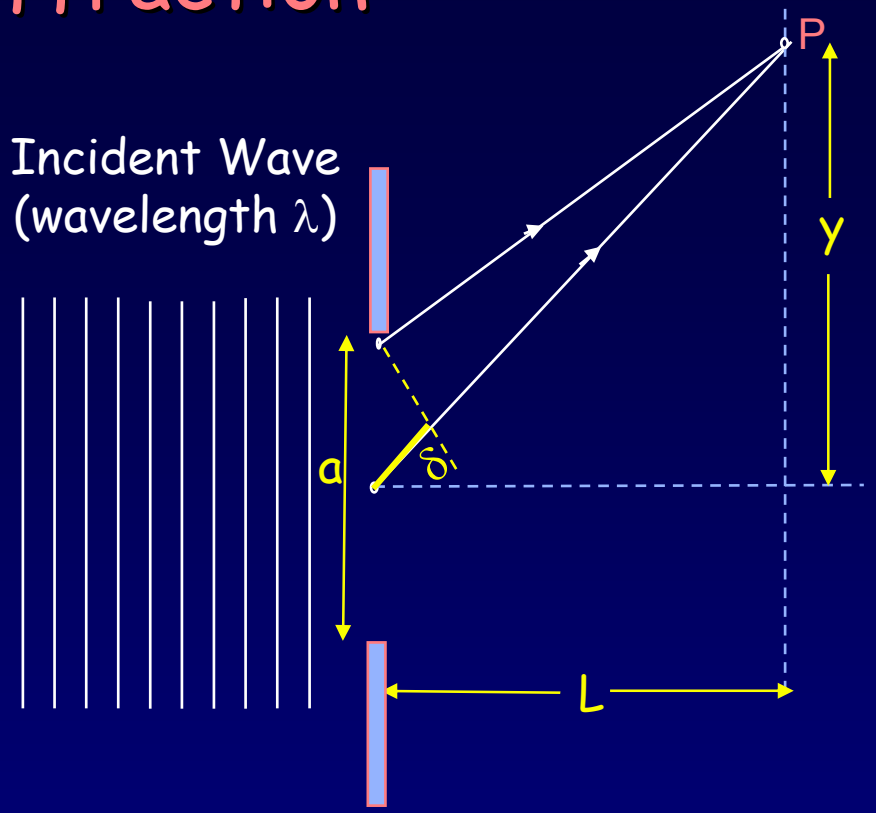
The first minimum is at an angle such that the light from the top and the middle of the slit destructively interfere.

This works, because for every point in the top half, there is a corresponding point in the bottom half that cancels it.



$$\delta = \frac{a}{2}\sin\theta_{\min} = \frac{\lambda}{2}$$

$$\Rightarrow \boxed{\sin\theta_{\min} = \frac{\lambda}{a}}$$



The second minimum is at an angle such that the light from the top and a point at a/4 destructively interfere:

$$\delta = \frac{a}{4}\sin\theta_{\min,2} = \frac{\lambda}{2} \qquad \Rightarrow \sin\theta_{\min,2} = \frac{2\lambda}{a}$$

Location of nth-minimum: $\sin\theta_{\min,n} = \frac{n\lambda}{a}$