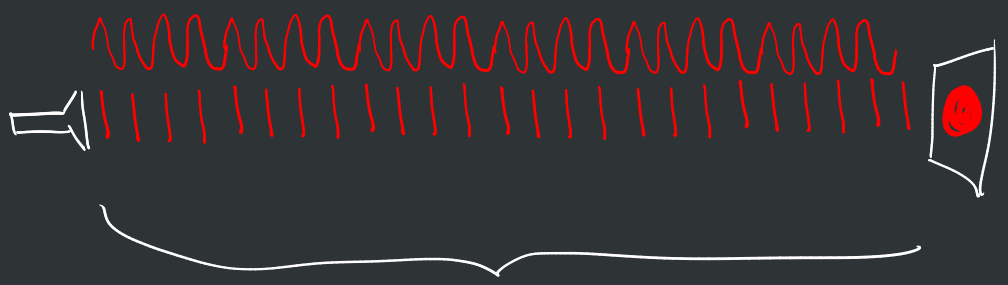
Chapter 9 - Interference + Diffraction

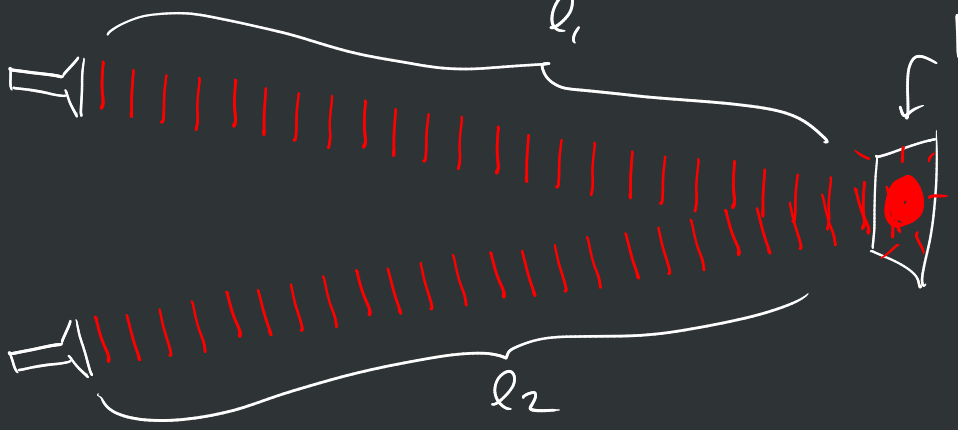
→ coherent light - single wavelength
- every part of the beam is "in phase" or lined up w/ itself

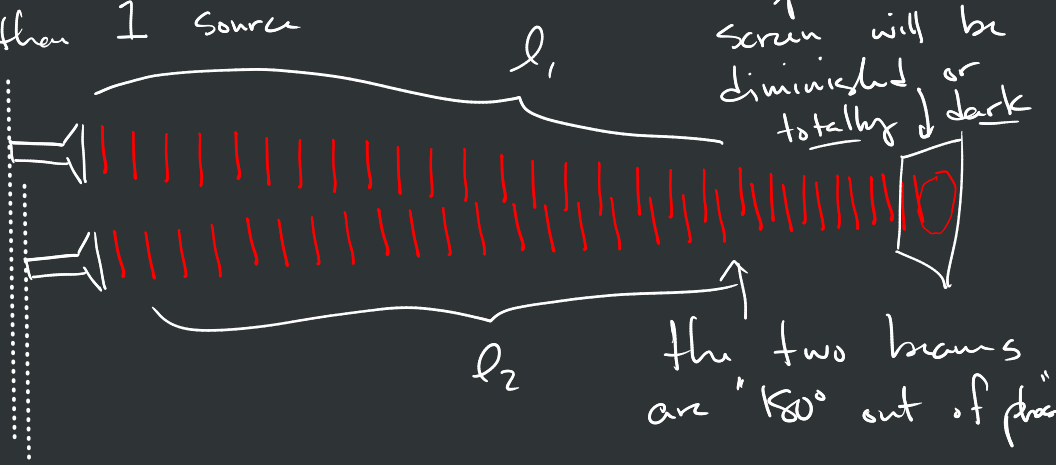


10.1 m

$\lambda = 0.33\,m$

$$\frac{\text{total distance}}{\text{a wavelength}} = \#\text{ of wavelengths} = \frac{10.1\,m}{0.33\,m} = 30.6$$





constructive interference

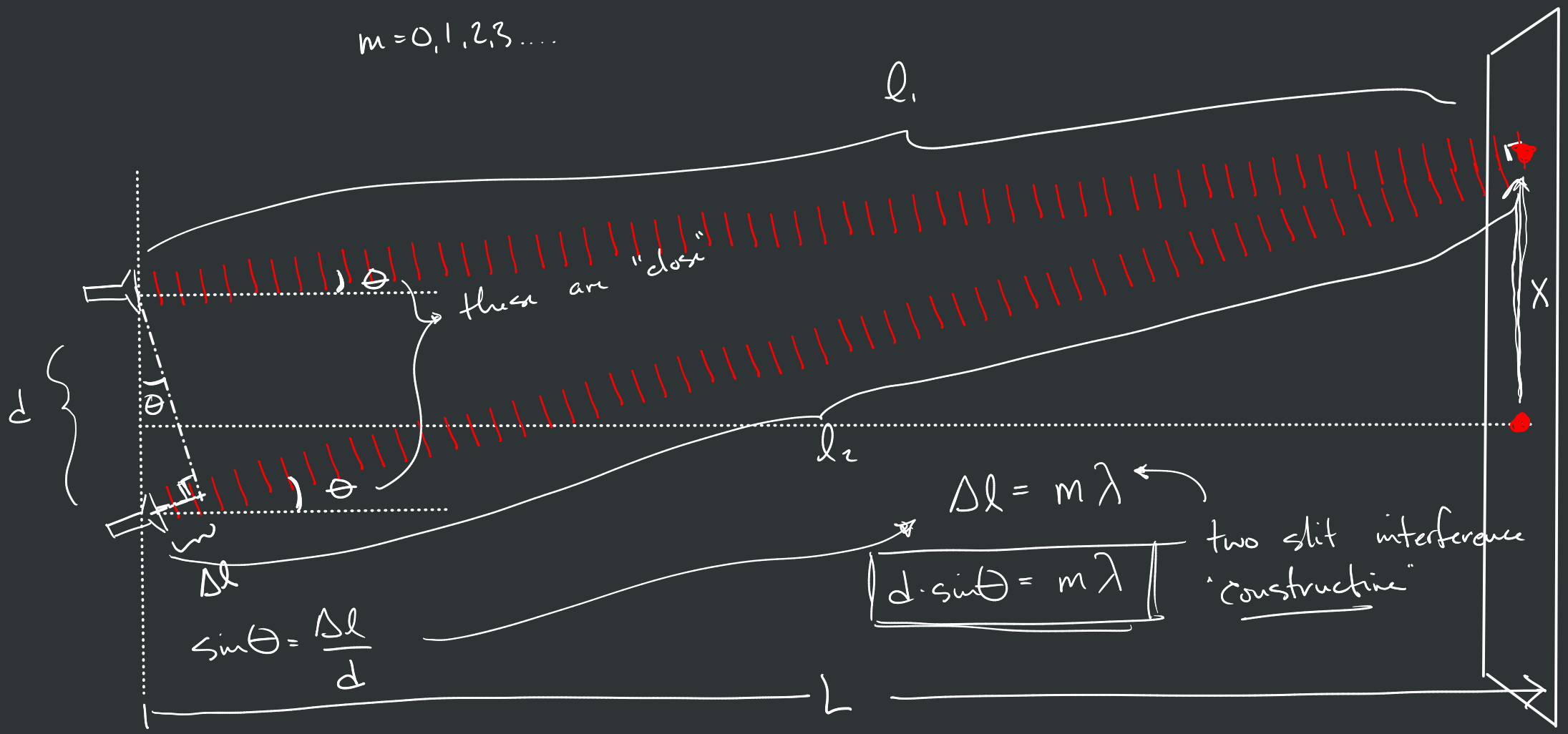
$$\Delta l = l_2 - l_1 = m\lambda$$

$$m = 0, 1, 2, 3 \ldots$$

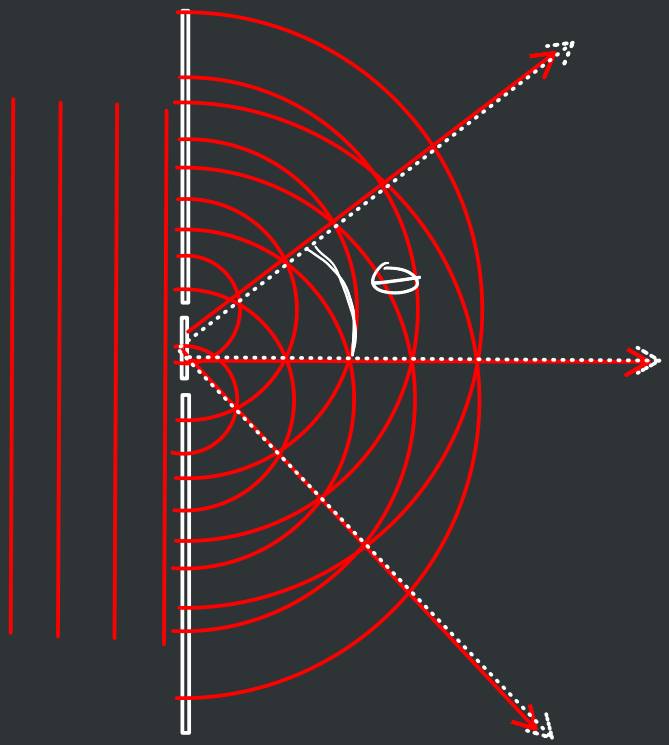
destructive interference

$$\Delta l = l_2 - l_1 = \left(m + \frac{1}{2}\right)\lambda$$

$$m = 0, 1, 2, 3 \ldots$$



$d \sin\theta = \left(m + \frac{1}{2}\right) \cdot \lambda$ two slit destructive interference



$$d \sin\theta = m\lambda$$

$$\tan\theta = \frac{x}{L}$$

small angle approximation

when θ is small

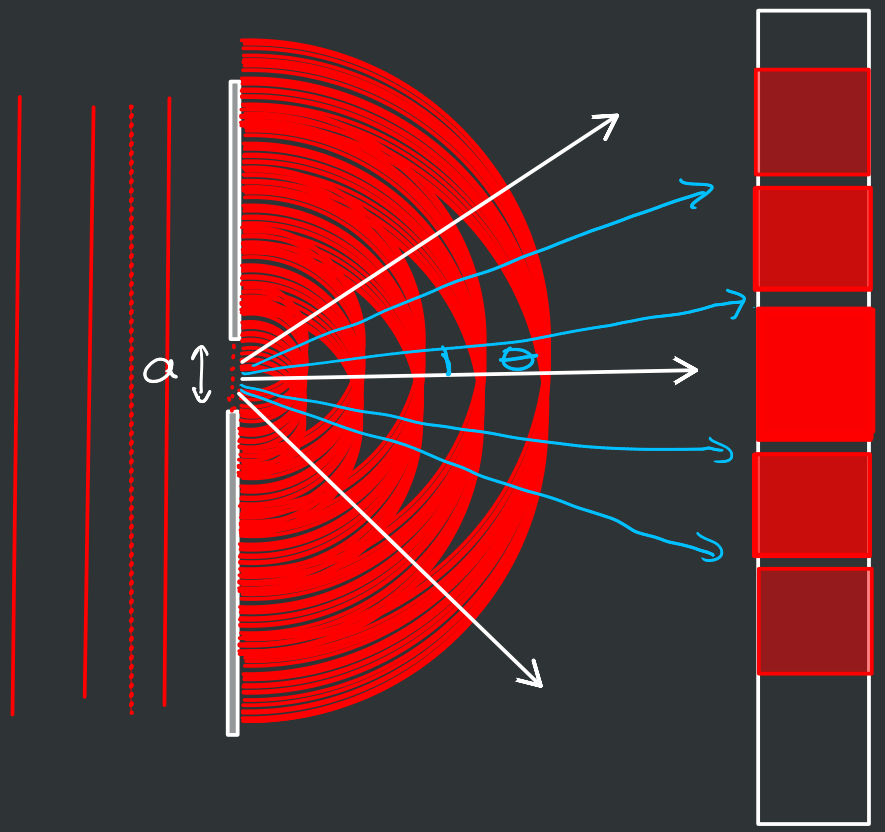
$$\tan\theta \approx \sin\theta \approx \theta \approx \frac{x}{L}$$

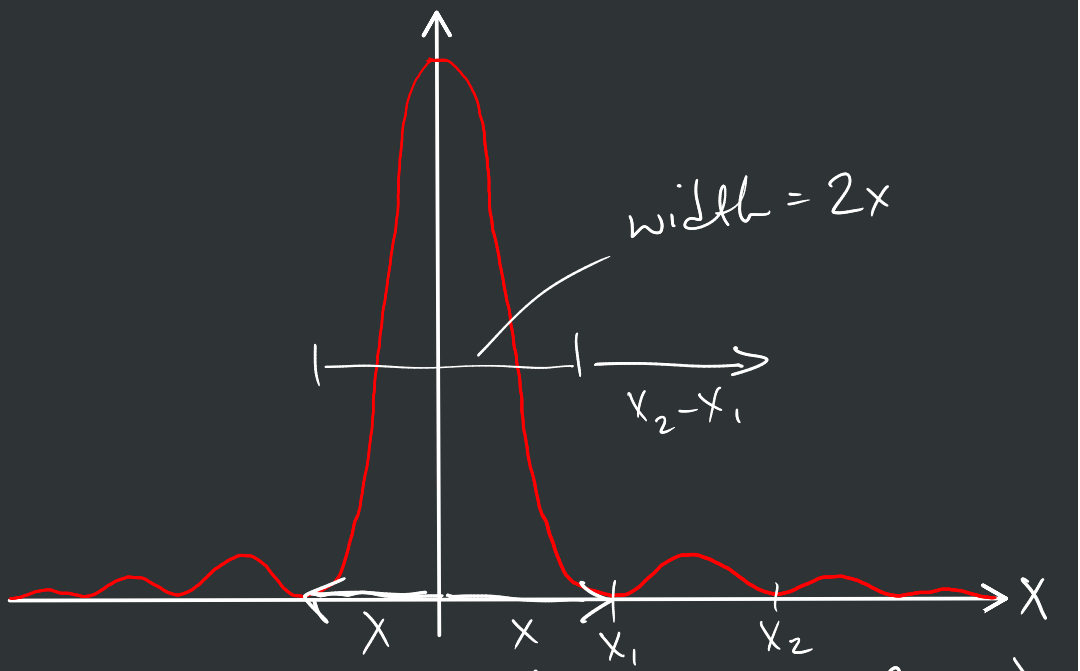
$$\boxed{d \cdot \frac{x}{L} = m\lambda}$$

← double slit constructive interference small angle approximation

$$x = \frac{m\lambda \cdot L}{d}$$

Single Slit Diffraction/Interference





location of the minima (destruction interference)

$a \cdot \sin\theta = m\lambda$

→ location from the central max to the minima

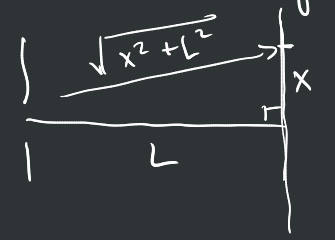
→ fringe number from the center

→ slit width

$\sin\theta = \frac{x}{L}$

$a \cdot \frac{x}{L} = m\lambda$

w/o small angle approx:



$\sin\theta = \frac{x}{\sqrt{x^2+L^2}}$

$\frac{a \cdot x}{\sqrt{x^2+L^2}} = m\lambda$