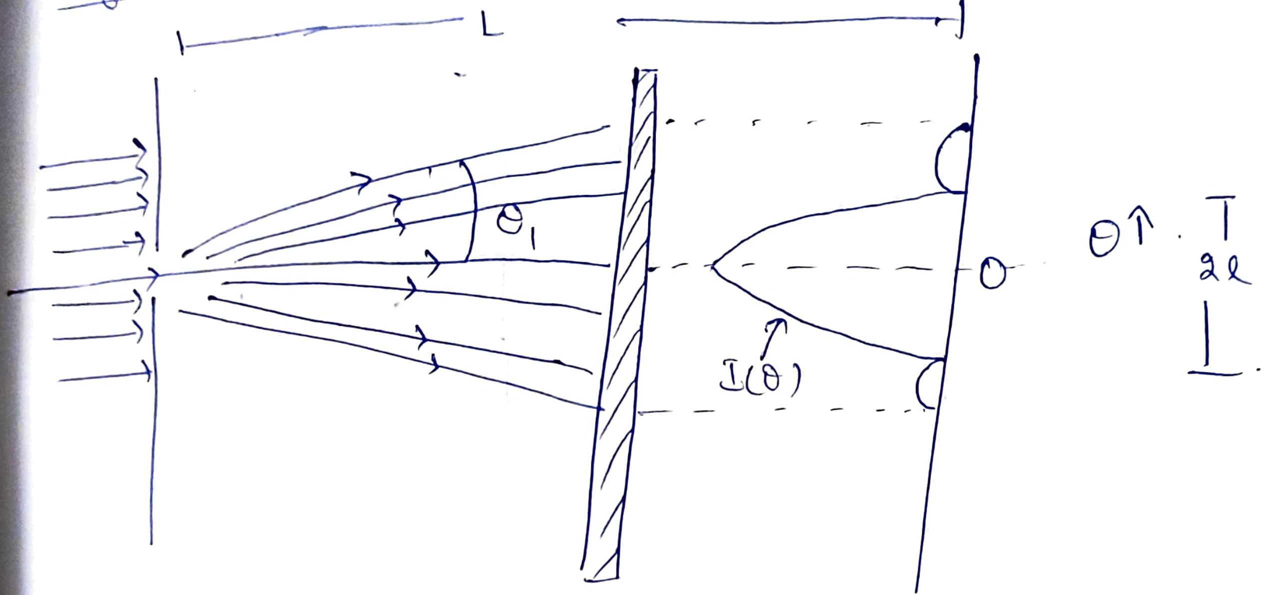
Diffraction pattern Due to Single-slit and a Circular Aperture :

Single slit Diffraction



$$I(\theta) = I(\beta) = \frac{I_0 \sin^2\beta}{\beta^2}, \quad \beta = \frac{\pi a \sin\theta}{\lambda}.$$

$$I_0 = I(\theta = 0)$$

- Minima when $\beta = m\pi$, $m = 1, 2, \ldots$ or $-1, -2, \ldots$

$$(\sin\theta)_{\theta_{min}} = \frac{m\lambda}{a}, \quad m = \pm 1, \pm 2, \ldots$$

$\sin\theta \approx \theta$ (or) $\theta_{min} = \frac{m\lambda}{a}$, $\tan\beta = \beta$.

→ $\frac{2l}{L} = \frac{2\lambda}{a}$, ⇒ $\lambda = \frac{al}{L}$.

where a is slit width, l is based on diffraction formed (intensity formed by that).

In double slit experiment

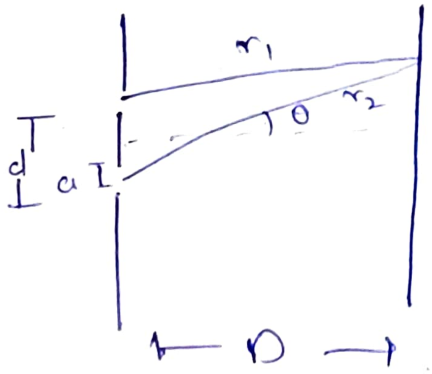
$$I(\theta) = \frac{I_0 \sin^2\beta \cos^2\gamma}{\beta^2}, \quad \beta = \frac{\pi}{\lambda} a\sin\theta$$

$$\gamma = \frac{\pi}{\lambda} d\sin\theta.$$

→ $I = 4 I_0 \cos^2 \frac{\theta}{2}$ (Max. Intensity).

$k = \frac{2\pi}{\lambda}$.

→ $r_2 - r_1 = d\sin\theta$.



* Linear width of central fringe.

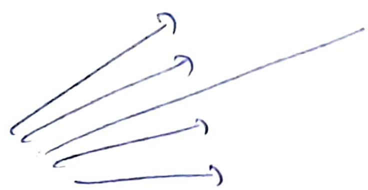
$\sin\theta = \frac{\lambda}{a}$, $\quad w = \frac{f\lambda}{a}$, $\quad f$ = focal length.

a = slit width.

λ = wavelength

* Diffraction by a circular Aperture

- The diagram is same as single slit, But it covers complete conical area.



resulting in airy patter on the screen.