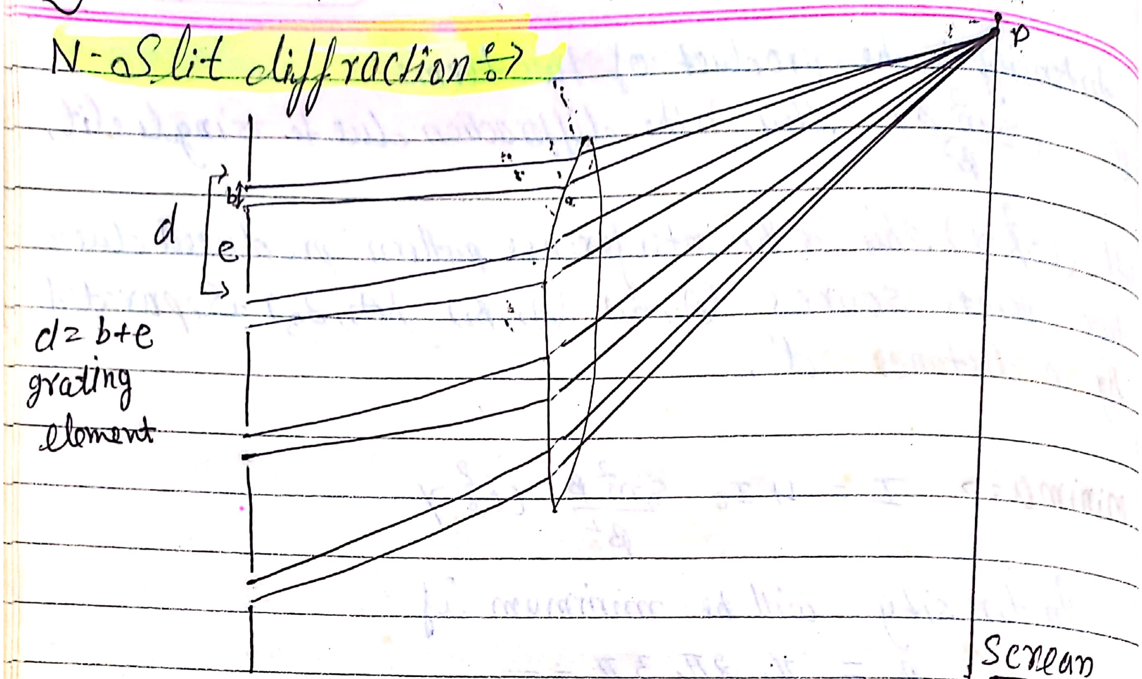
N-Slit diffraction:-



$$E = A\frac{\sin\beta}{\beta}\cos(\omega t-\beta) + A\frac{\sin\beta}{\beta}\cos(\omega t-\beta-\phi_1) \cancel{+} A\frac{\sin\beta}{\beta}\cos(\omega t-\beta-(n-1)\phi_1)$$

$$E = A\frac{\sin\beta}{\beta}\cos\left(\omega t-\beta-\frac{1}{2}(n-1)\phi_1\right)\frac{\sin N\gamma}{\sin\gamma}$$

$$I = I_0\frac{\sin^2\beta}{\beta^2}\frac{\sin^2 N\gamma}{\sin^2\gamma}$$

$I_0\frac{\sin^2\beta}{\beta^2}$ is single slit diffraction term.

$\frac{\sin^2 N\gamma}{\sin^2\gamma}$ Interference putern produced by N equally space point soureis

$N=1$

$$I = I_0\frac{\sin^2\beta}{\beta^2}\frac{\cancel{\sin^2\gamma}}{\cancel{\sin^2\gamma}} = I_0\frac{\sin^2\beta}{\beta^2}$$

$N=2$

$$I = I_0\frac{\sin^2\beta}{\beta^2}\frac{\sin^2 2\gamma}{\sin^2\gamma} = I_0\frac{\sin^2\beta}{\beta^2}\cdot\frac{4\cancel{\sin^2\gamma}\cos^2\gamma}{\cancel{\sin^2\gamma}}$$

$$I = 4I_0 \frac{\sin^2\beta}{\beta^2} \cdot \cos^2\gamma$$

$$\boxed{I = 4 I_0 \frac{\sin^2\beta \cdot \cos^2\gamma}{\beta}}$$

Principle max:-> where N is very large we obtain intensity maxima at $\gamma = m\pi$

$$\frac{\pi d \sin\theta}{\lambda} = m\pi$$

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

$$\lim_{\gamma \to m\pi} \frac{\sin N\gamma}{\sin\gamma} = \pm N$$

$$E = \frac{A\sin\beta}{\beta} N$$

$$\boxed{I = N^2 I_0 \frac{\sin^2\beta}{\beta^2}}$$

Such maxima are called as principle maxima. at these maxima the fields produced by each of the slit are in phase and they addup to give resultant field which is N times to the field produce by the slit.

Minima:-> For minima.

(i) $\beta = n\pi$

$b\sin\theta = n\lambda$

(ii) $N\gamma = p\pi$ $\left\{ \gamma \neq 0 \right.$ whose will give pr max

where $p \neq N, 2N, 3N,$

$p = 0, N, 2N$

$\gamma = 0, \pi, 2\pi$

For these values the denominator of $\frac{\sin^2 N\gamma}{\sin^2\gamma}$ will vanish and we have principle maxima i.e by p shout not 0, N, 2N and so-on Hence other value of p will give the minimum intensity

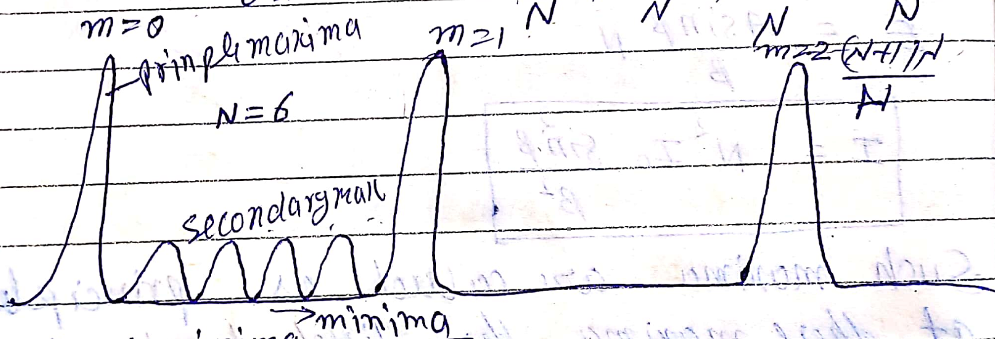
$$N\gamma = p\pi$$

$$\frac{\pi d\sin\theta}{\lambda} = \frac{p}{N}\pi$$

$$d\sin\theta = \frac{p\lambda}{N}$$

$$p = 1, 2, 3, 4$$

$$d\sin\theta = \frac{\lambda}{N}, \frac{2\lambda}{N}, \frac{3\lambda}{N} \ldots \frac{(N-1)\lambda}{N}$$



(N−1) minima

(N−2) maxima.

between two principle maxima we have (N−1) minima. B/w two such consiquative minima the intensity has to have maximum. These maxima is called secondary maxima.

It means if the NO of ~~sli~~ slit are 6 then there should be (6−1) = 5 minima and (6−2) = 4 2° maxima

2° maxima can be determine as follows.

$$\frac{d}{d\gamma}\left(\frac{\sin N\gamma}{\sin\gamma}\right) = 0$$