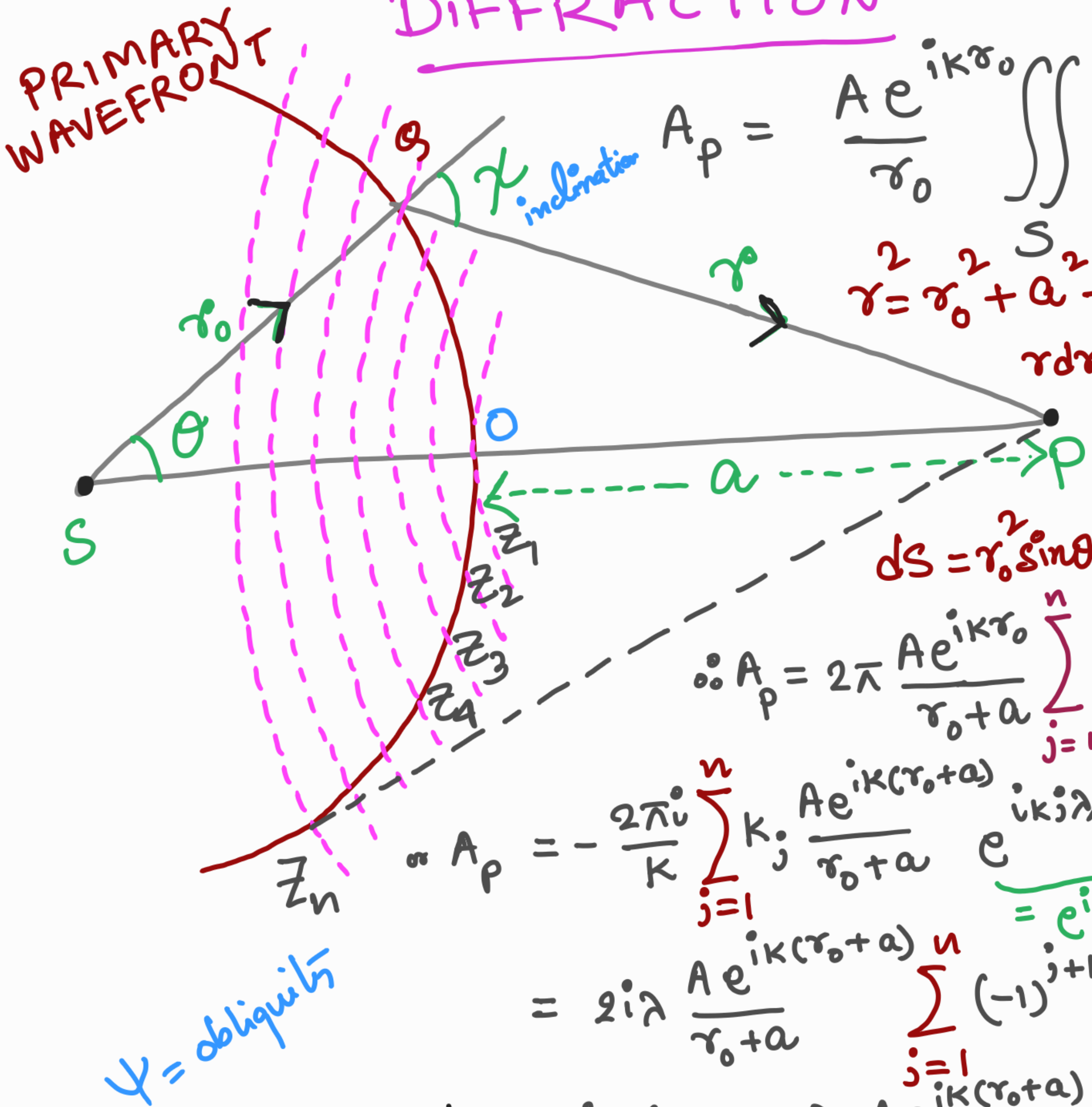
DIFFRACTION



$$A_p = \frac{Ae^{ikr_0}}{r_0}\iint_S \frac{e^{ikr}}{r}K(\chi)dS$$

$$r^2 = r_0^2 + a^2 - 2r_0(r_0+a)\cos\theta$$

$$r\,dr = r_0(r_0+a)\sin\theta\, d\theta$$

$$k\lambda = 2\pi$$

$$dS = r_0^2\sin\theta\, d\theta\, d\phi = \frac{r_0}{r_0+a}\, r\, dr\, d\phi$$

$$\therefore A_p = 2\pi\frac{Ae^{ikr_0}}{r_0+a}\sum_{j=1}^{n}K_j\int_{a+(j-1)\frac{\lambda}{2}}^{a+j\lambda/2} e^{ikr}dr$$

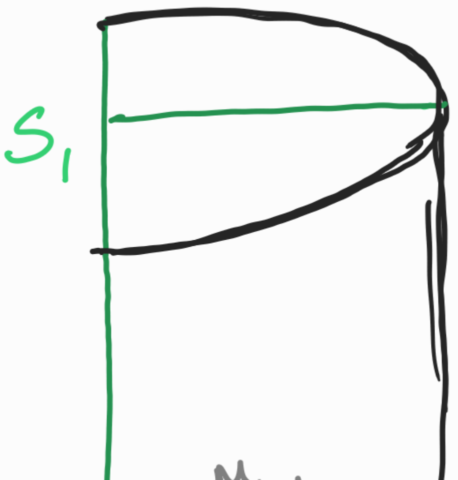
$$\therefore A_p = -\frac{2\pi i}{k}\sum_{j=1}^{n}K_j\frac{Ae^{ik(r_0+a)}}{r_0+a}\underbrace{e^{ikj\lambda/2}(1-e^{-ik\lambda/2})}_{=e^{i\pi j}(1-e^{-i\pi})=(-1)^j 2}$$

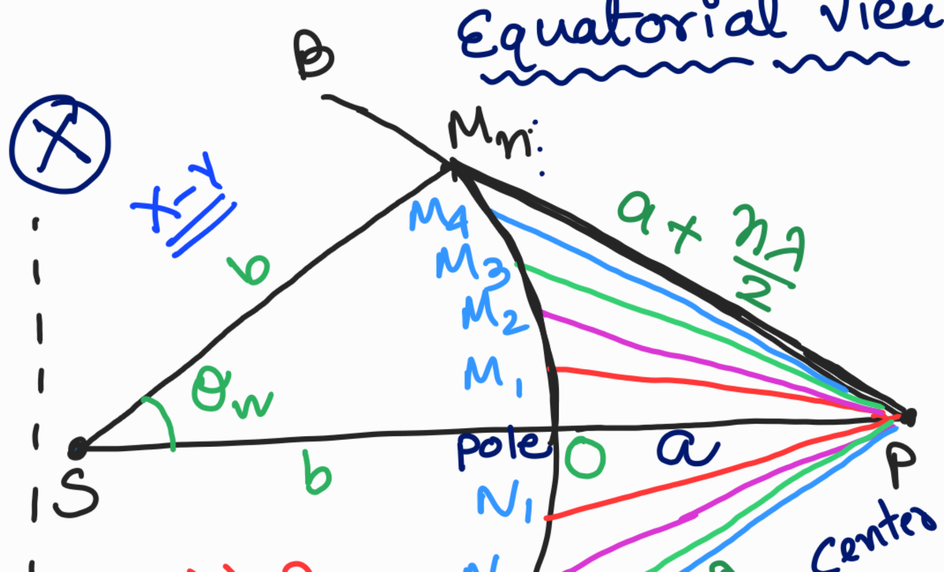
$$= 2i\lambda\frac{Ae^{ik(r_0+a)}}{r_0+a}\sum_{j=1}^{n}(-1)^{j+1}K_j$$

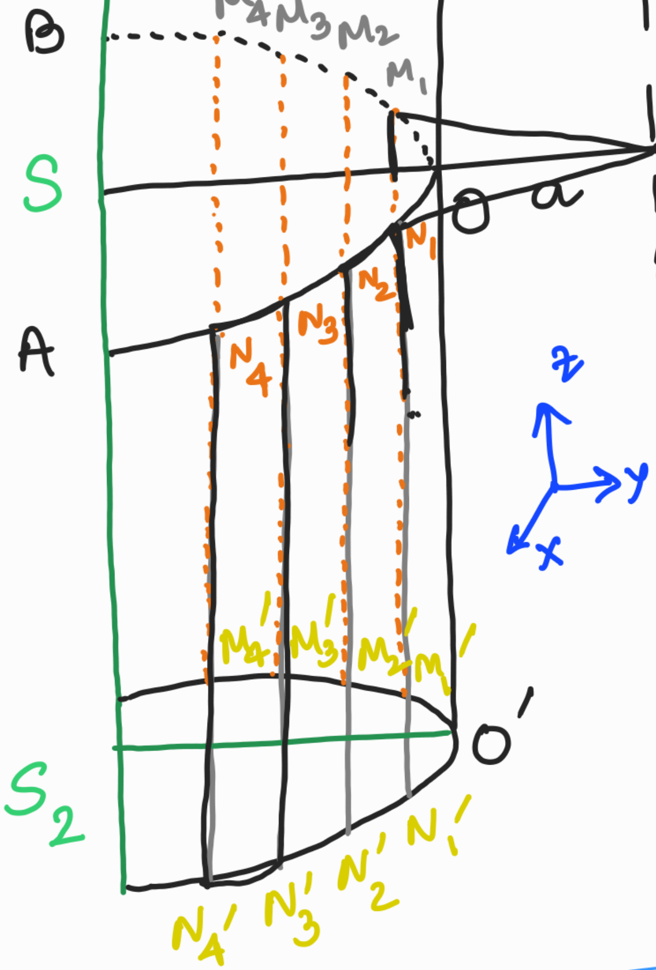
$$A_p \simeq i\lambda\underbrace{(K_1 \pm K_n)}_{=1}\frac{Ae^{ik(r_0+a)}}{r_0+a} \simeq \frac{1}{2}A_p^1 \pm \frac{1}{2}A_p^n$$

For A_p^n, $\chi = \pi/2$ so $K_j = 0$, $\therefore A_p^n = 0$, $\boxed{K_1 = \frac{1}{i\lambda}}$

FRESNEL'S STRIP

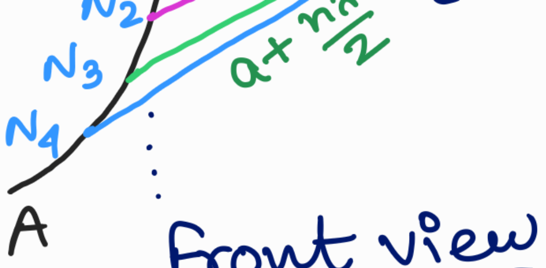




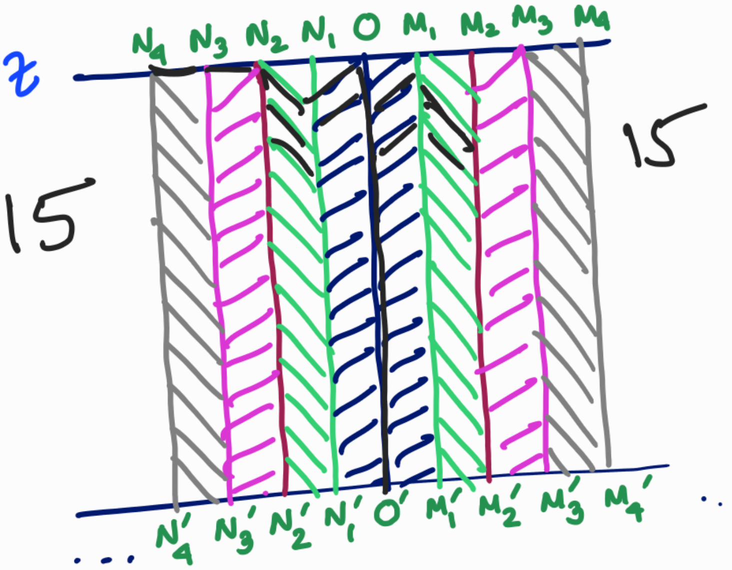


$a, b >> \lambda$

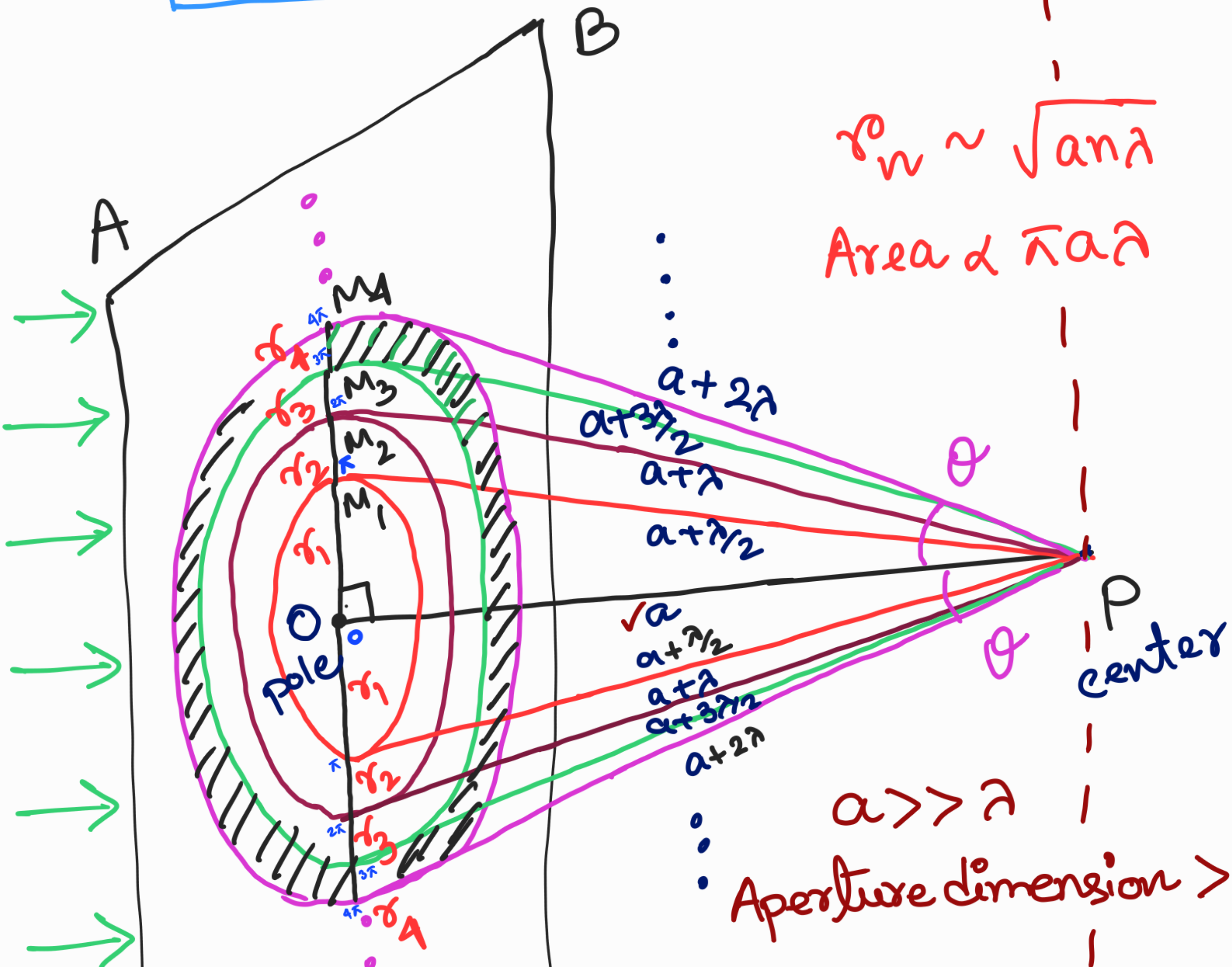
$\theta_n \propto \sqrt{n}$



Front view



FRESNEL'S ZONE

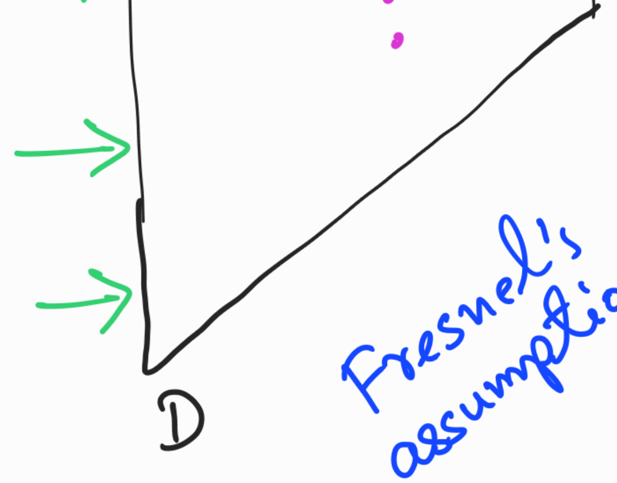


$r_n \sim \sqrt{an\lambda}$

Area $\propto \pi a \lambda$

$a >> \lambda$

Aperture dimension $>> \lambda$



Fresnel's assumptions

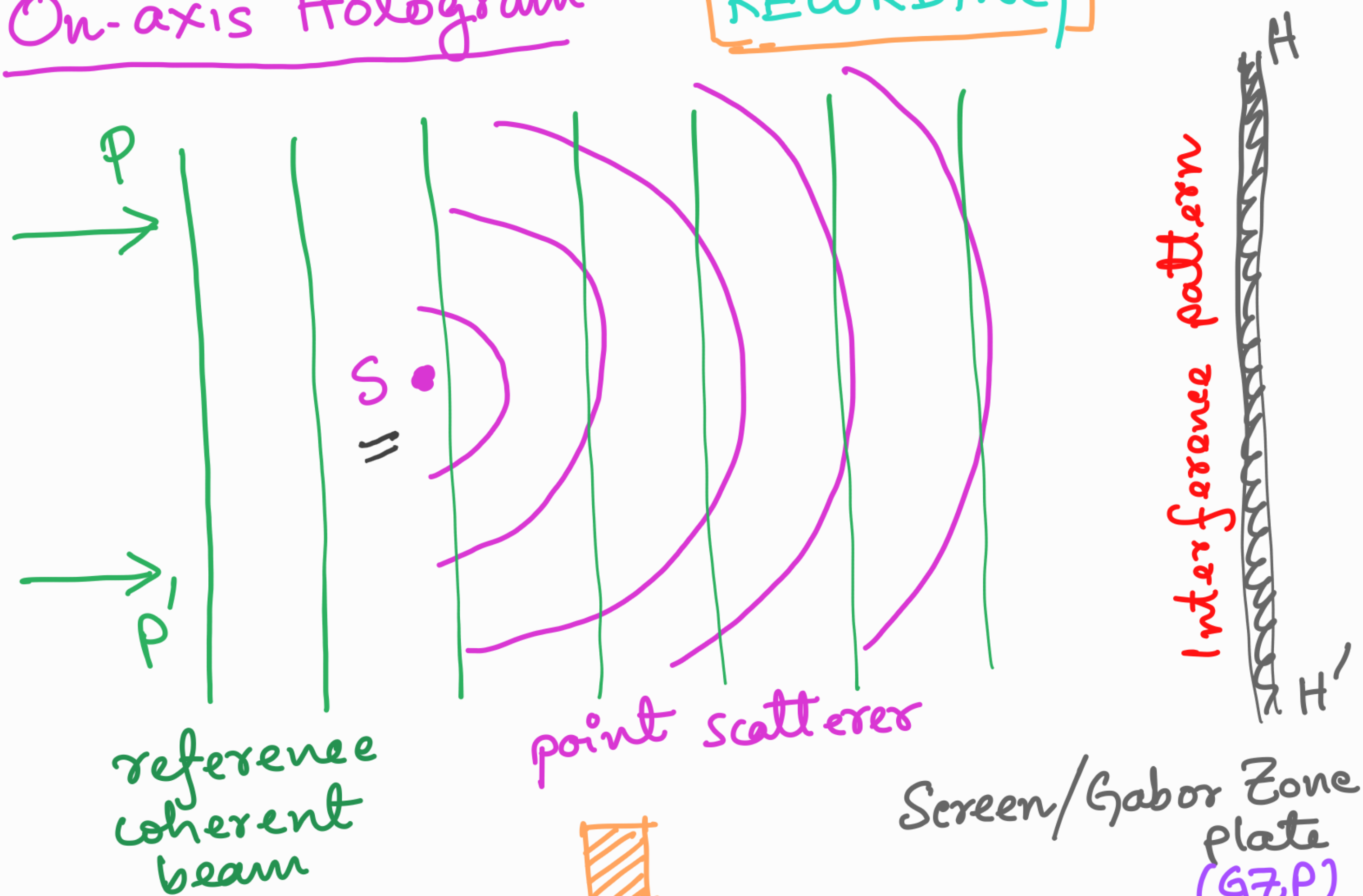
Amplitude $d_m \propto$ Area

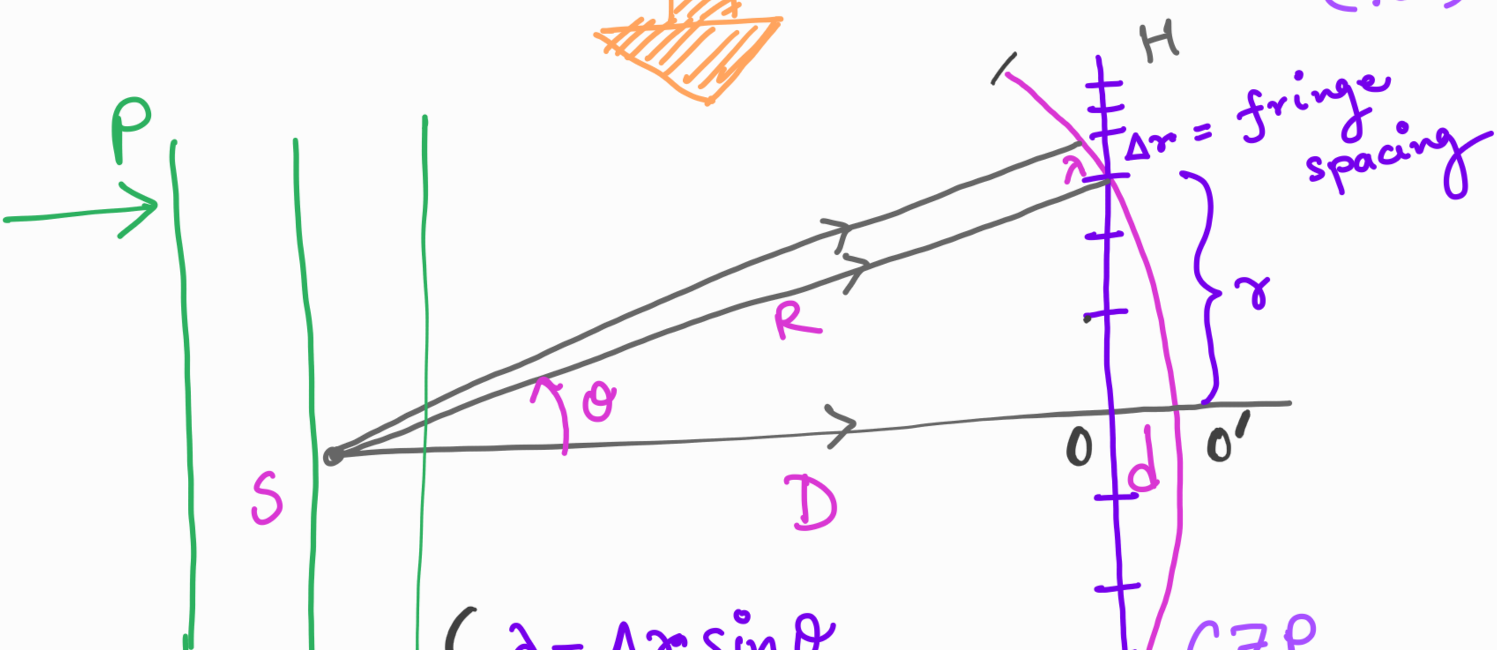
$\propto \frac{1}{a+m\lambda/2}$

$\propto 1+\cos\theta$

On-axis Hologram

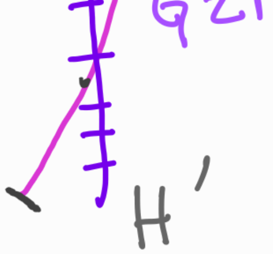
RECORDING



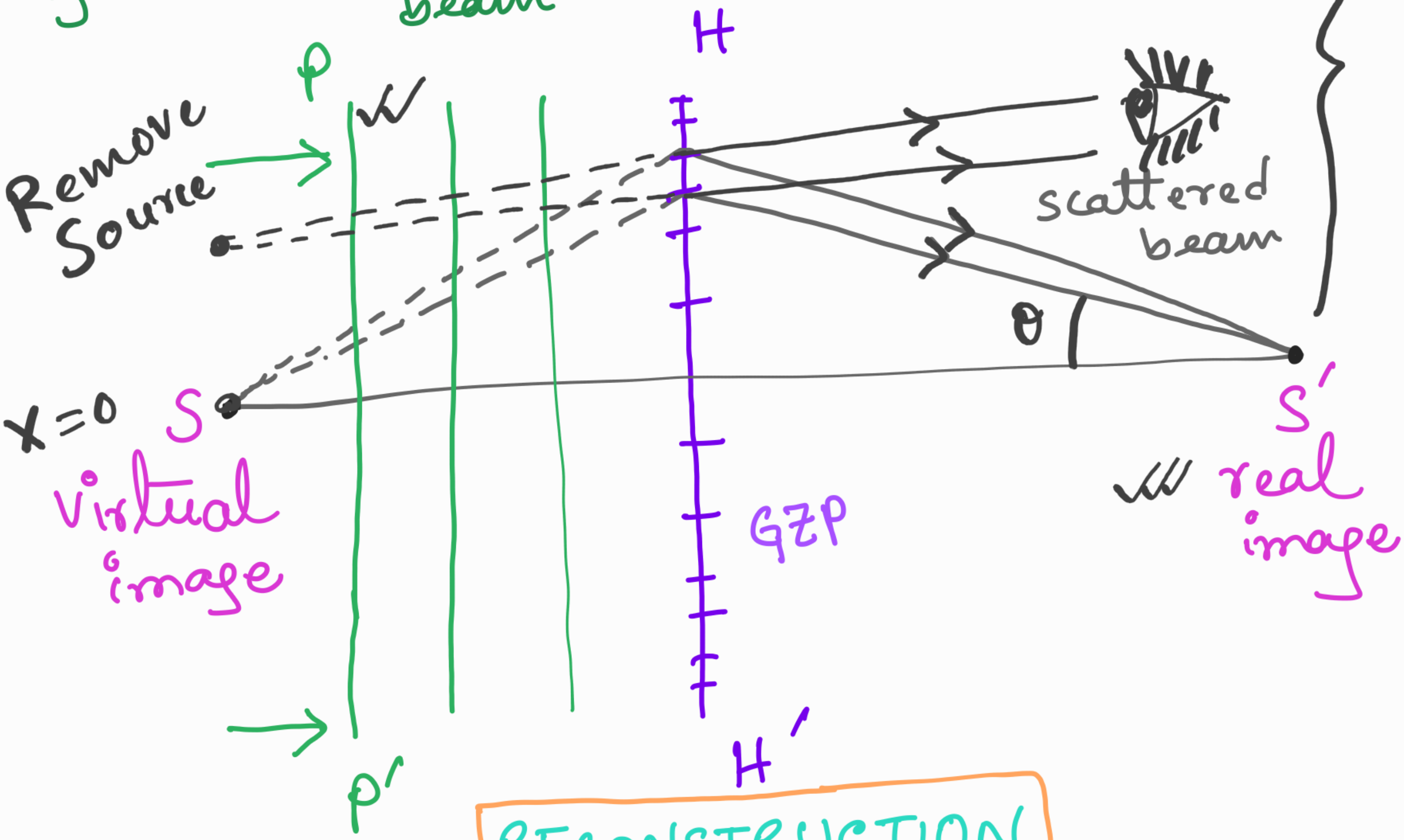


($\lambda = \Delta r \sin\theta$

$$\begin{cases} D + d = R \\ d = n\lambda = \dfrac{r^2}{2R-d} \end{cases}$$



reference coherent beam



RECONSTRUCTION

Difficulty : (A) Strict coherence → LASER

(B) Real image is on the right of Gabor Zone plate & comes in between of eye & virtual image.

→ OFF-AXIS HOLOGRAM (Leith & Upatnieks, 1962)

planewave requirement of reference beam not required

object can be illuminated from any side of GZP

separate real & virtual image; separate reference & scattered beam

Beam [illegible]