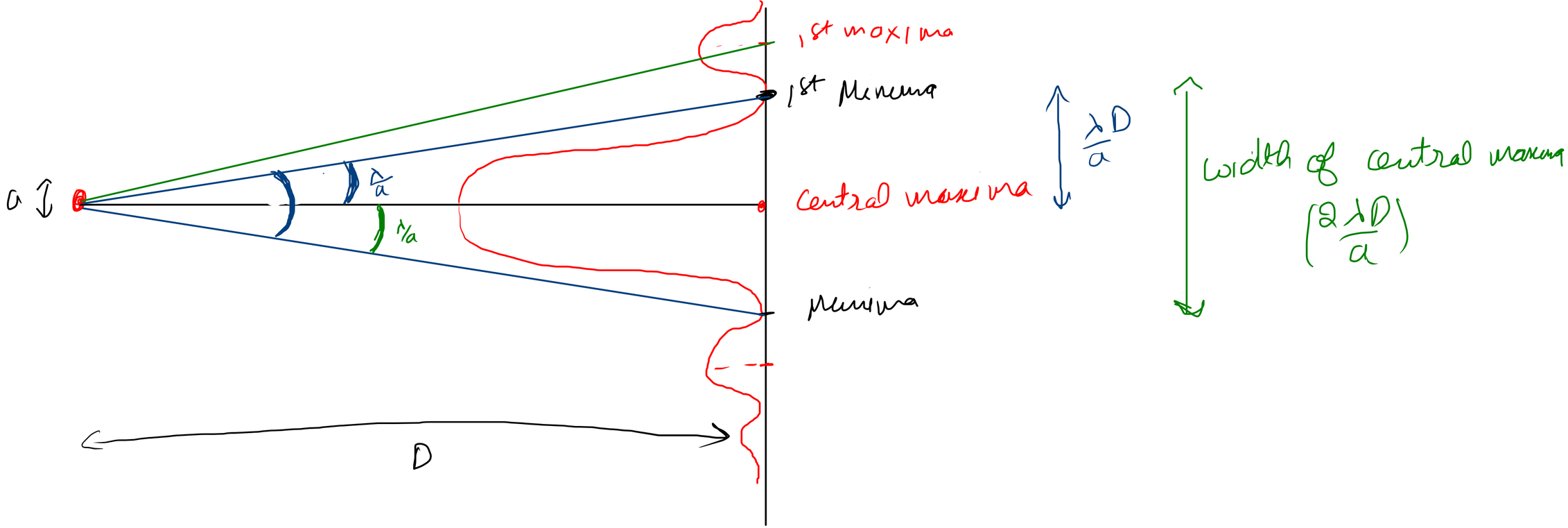
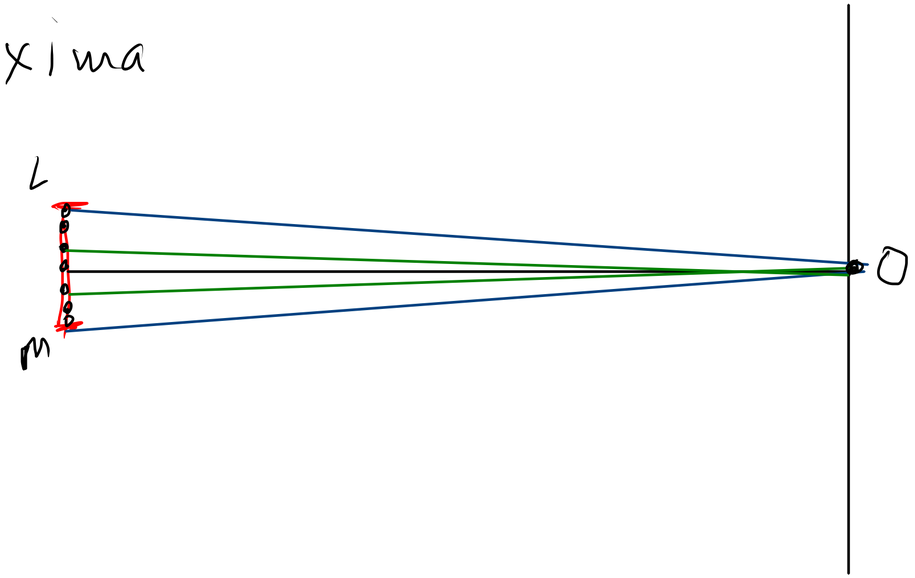
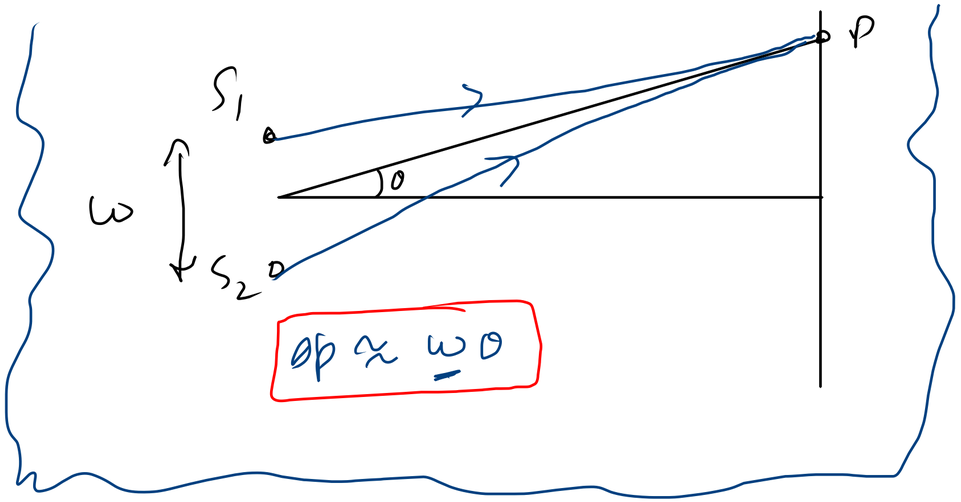


The angle made by central maxima on the center of the slit is $\left(2\frac{\lambda}{a}\right)$

* central maxima





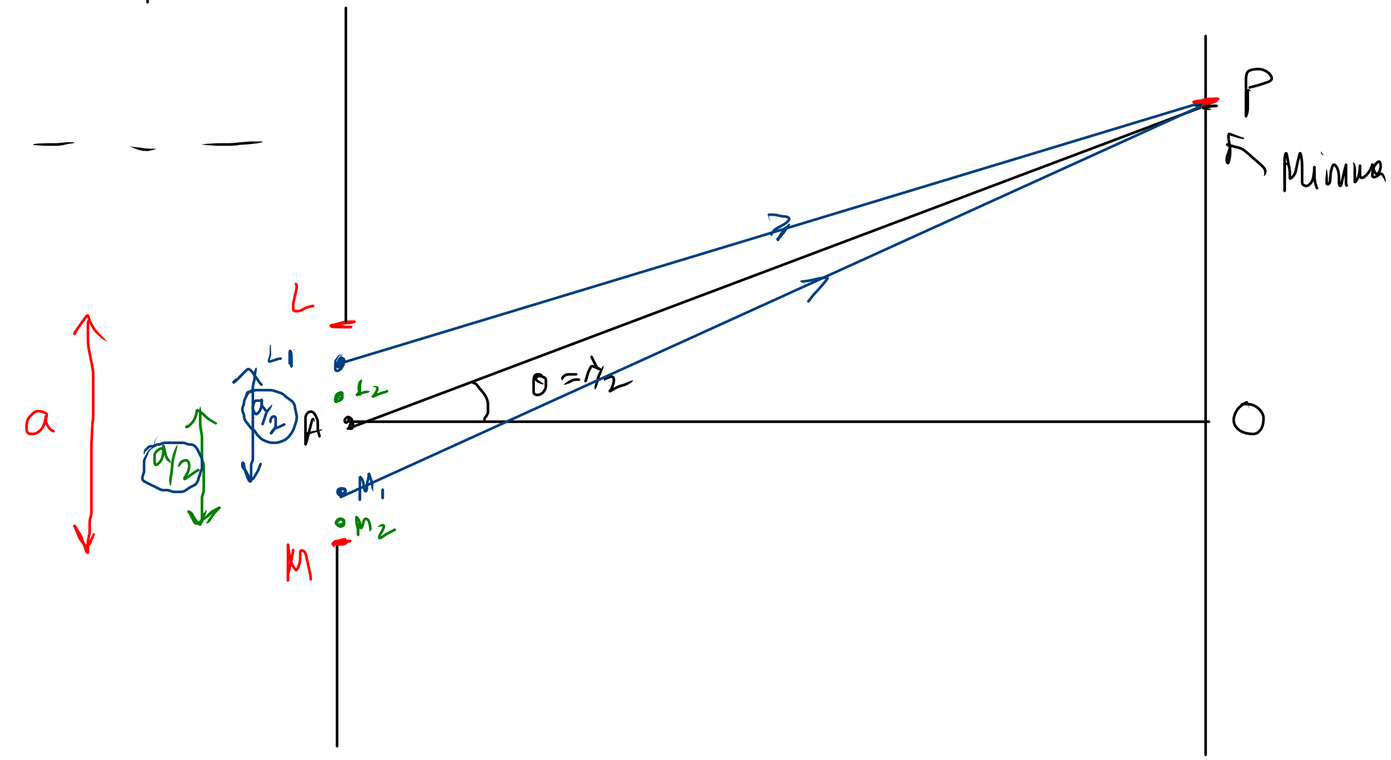
*

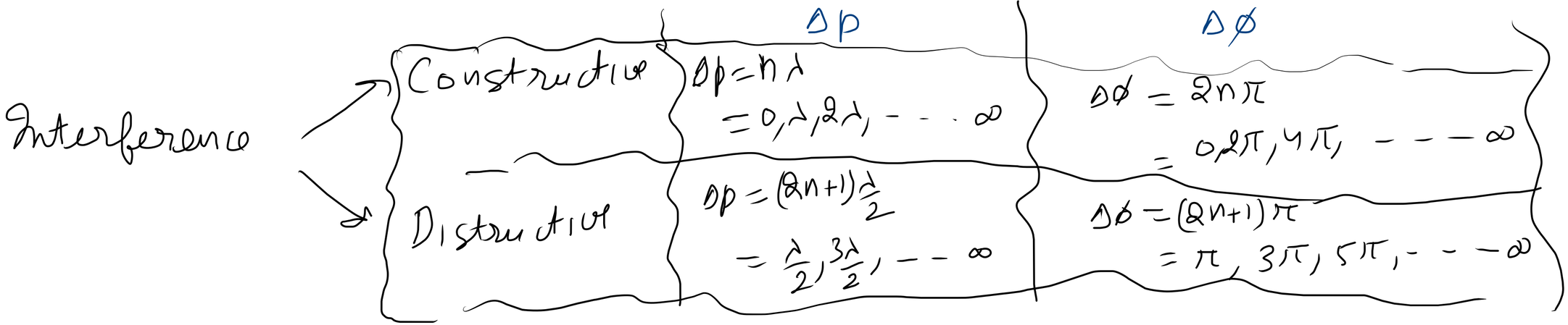
Minima $\theta = \frac{n\lambda}{a} = \pm\frac{\lambda}{a}, \pm\frac{2\lambda}{a}, - - -$

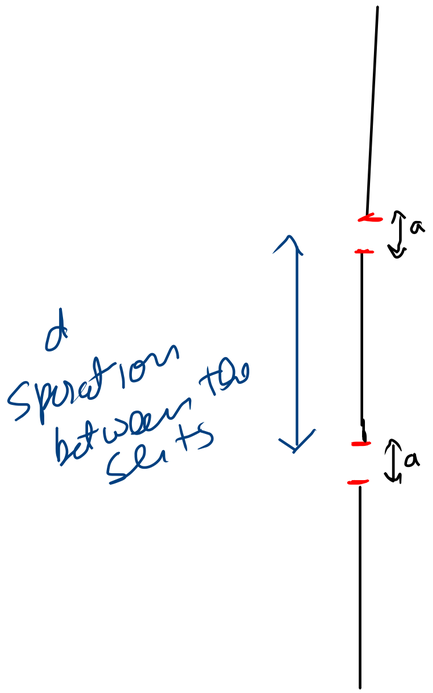
↳ 1st minima $\theta = \frac{\lambda}{a}$

*Path diff between waves from L_1 and M_1,

$\Delta_P = \left(\frac{a}{2}\right)\theta = \frac{a}{2}\frac{\lambda}{a} = \frac{\lambda}{2}$ ↓ Distructive

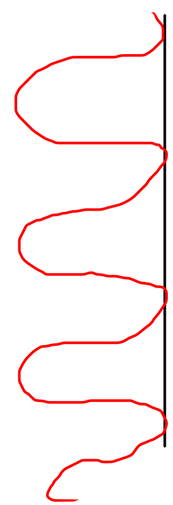



Δp
Δϕ
Interference
Constructive
Δp = nλ
= 0, λ, 2λ, - - - ∞
Δϕ = 2nπ
= 0, 2π, 4π, - - - ∞
Distructive
Δp = (2n+1) λ/2
= λ/2, 3λ/2, - - ∞
Δϕ = (2n+1)π
= π, 3π, 5π, - - - ∞

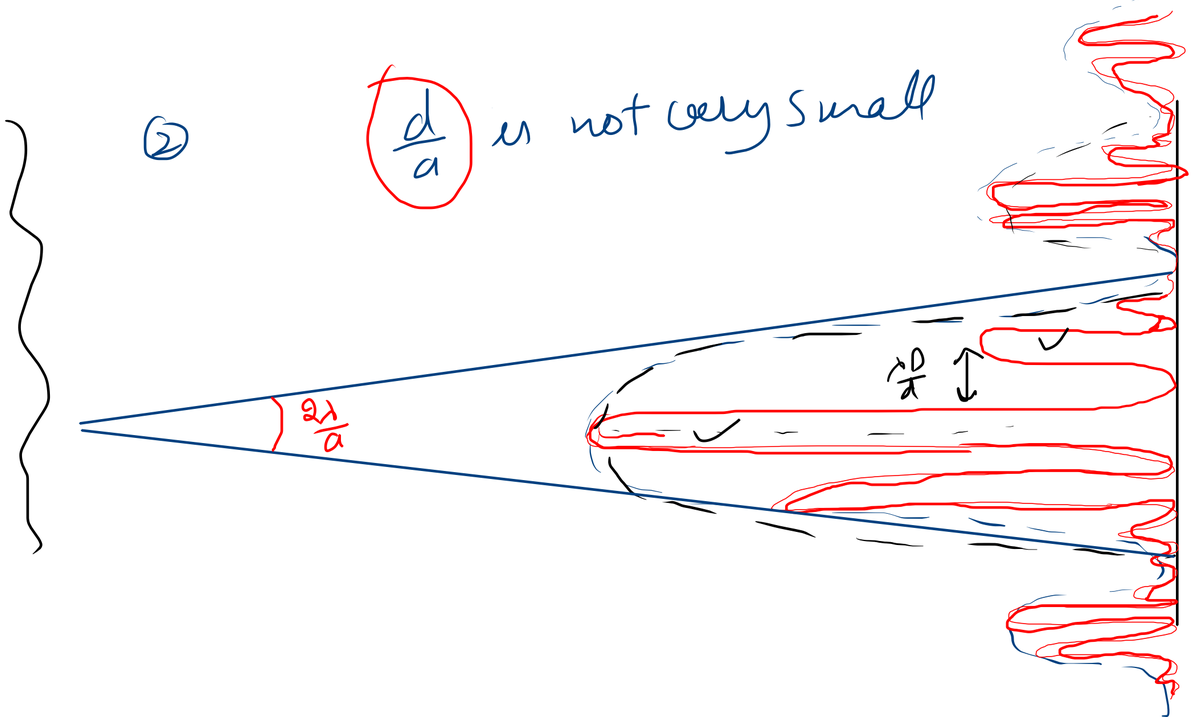


in double slit experiment the pasttern on the screen is combination of diffraction and interference.

(1) $\frac{d}{a}$ is very small



(2) $\frac{d}{a}$ is not very small



Ex $D = 1\ m$ $d = 10^{-3}\ m$ $\lambda = 500\ nm$

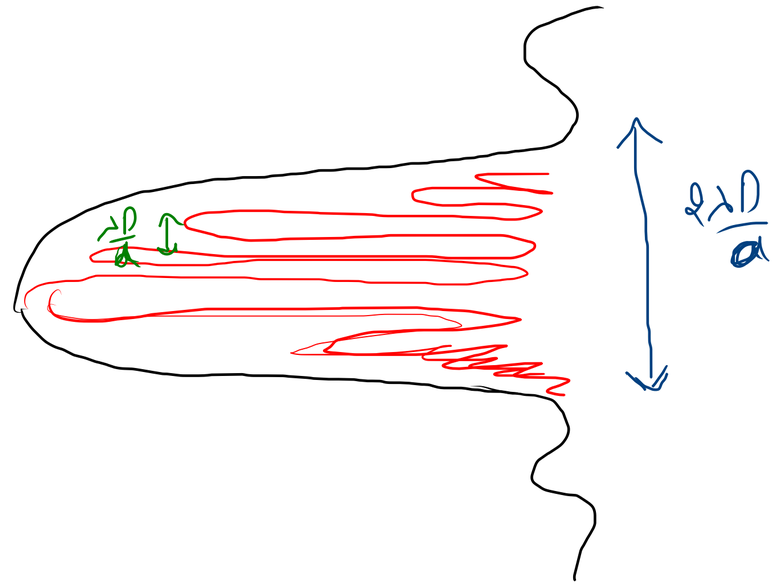
a = width of slit

$10\left(\frac{\lambda D}{d}\right) = \frac{2\lambda D}{a}$

width of 10 maxima's (10 DSF)

width of central maxima (SSD)

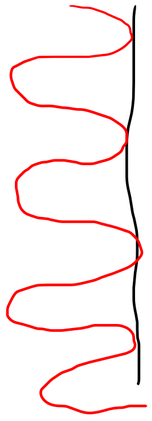
single slit diffraction



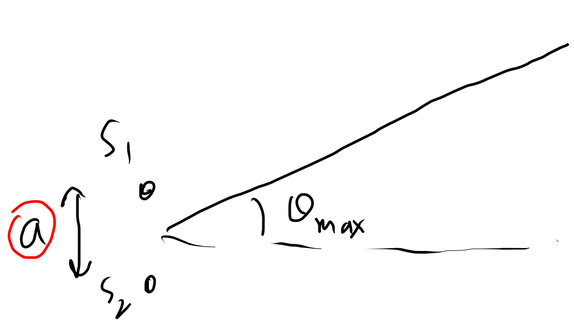
YDSE

(1) two slits

(2) Fringes are equally space



(3)

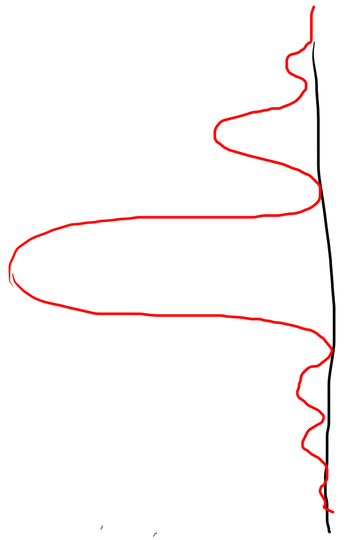


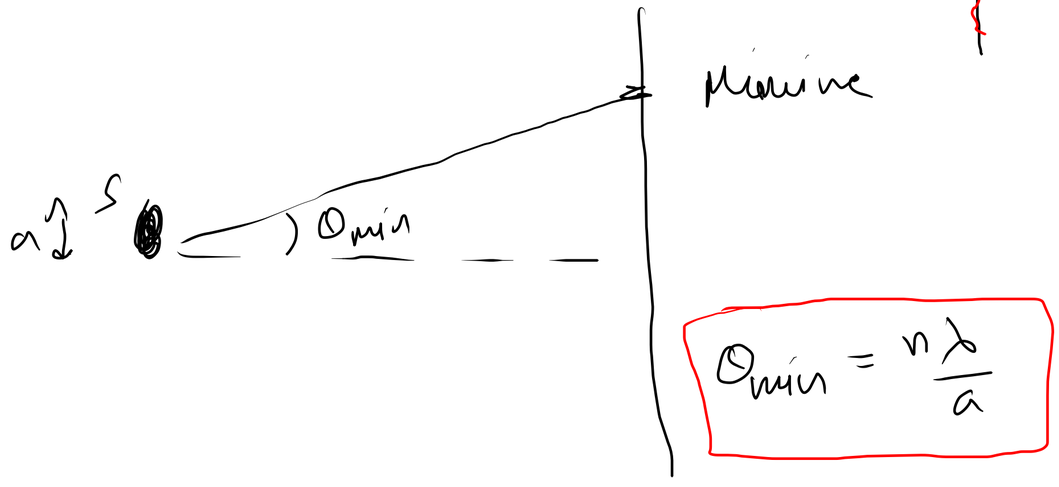
$$\theta_{max} = \frac{n\lambda}{a}$$

SSD

(1) One slit

(2) There is a broader Central maxima

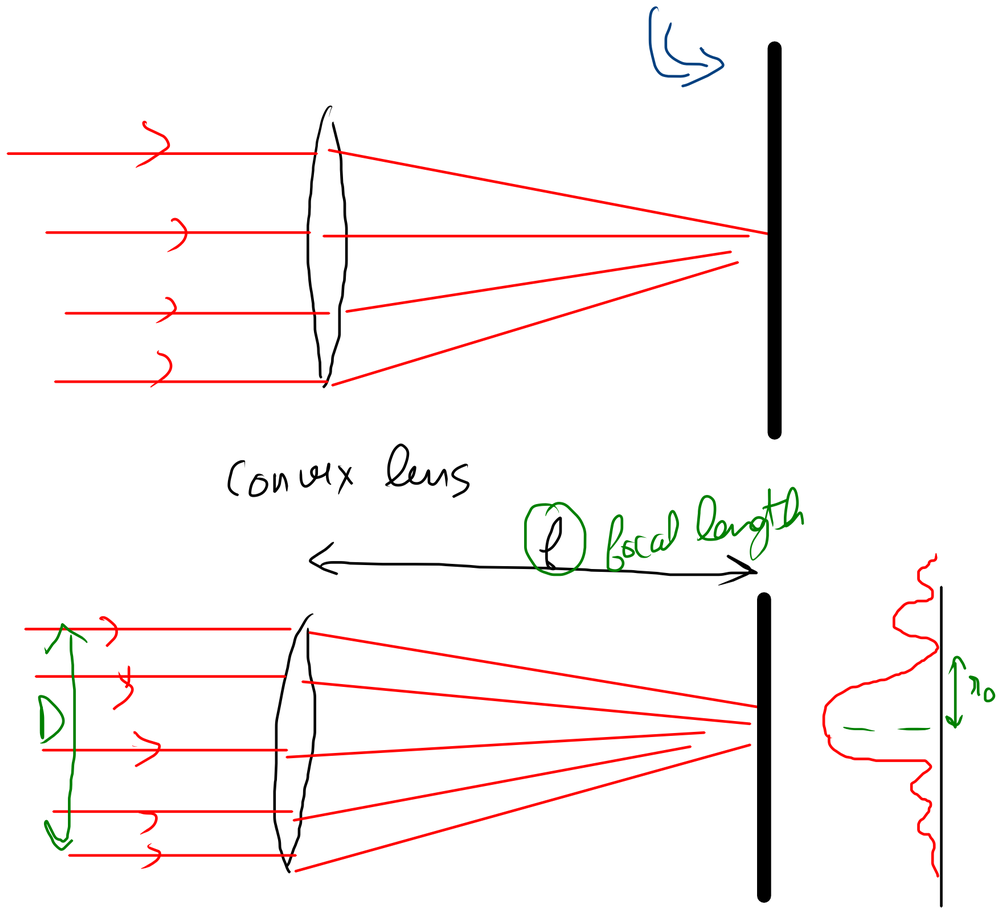


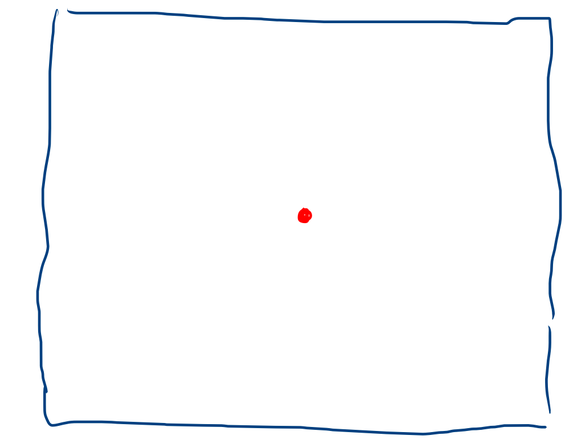


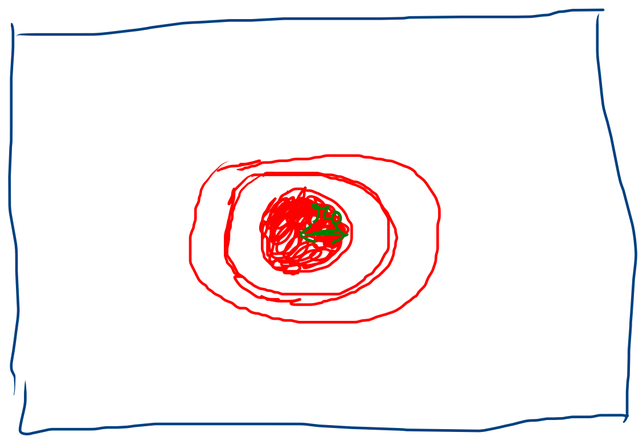
$$\theta_{min} = \frac{n\lambda}{a}$$

- Effect of diffraction on Optical intruments

ex. telescope, microscope





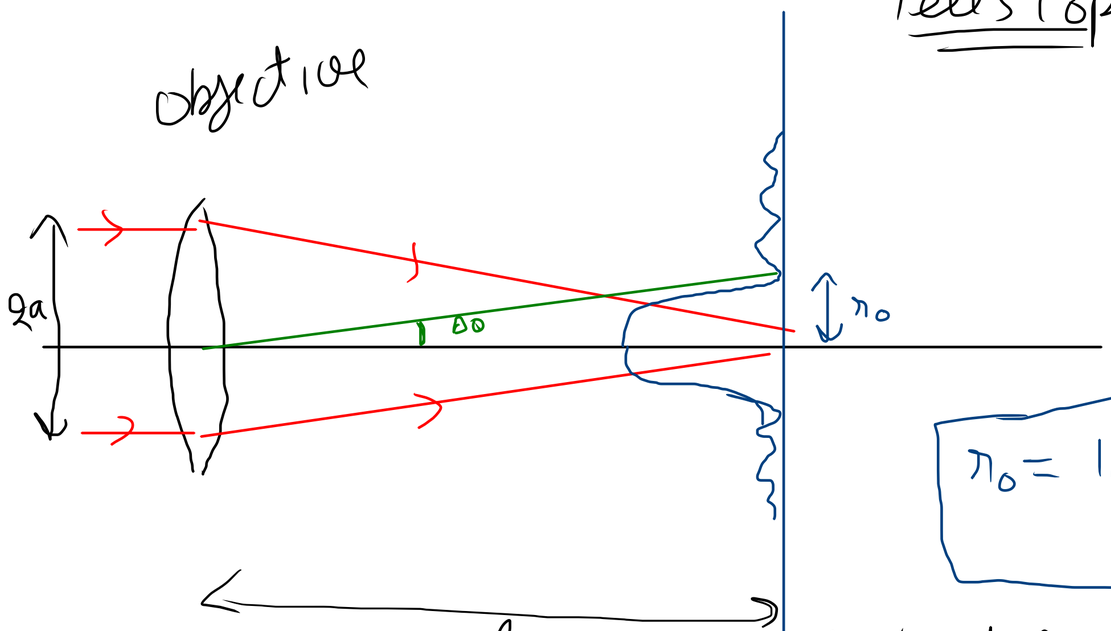


Due to diffraction instead of a point , the parllel rays will focus at a spot of finite area

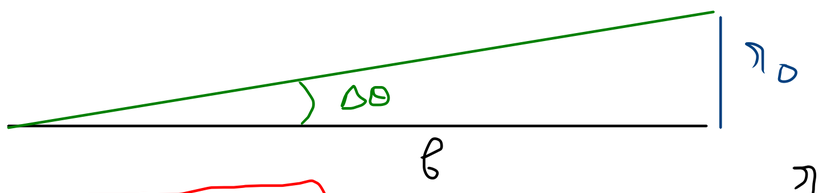
$$r_0 = \frac{1.22 \lambda f}{D}$$

D: apparture (diameter of lens)

Telescope (Limit of Resolution)



$$r_0 = \frac{1.22\,\lambda f}{(2a)}$$

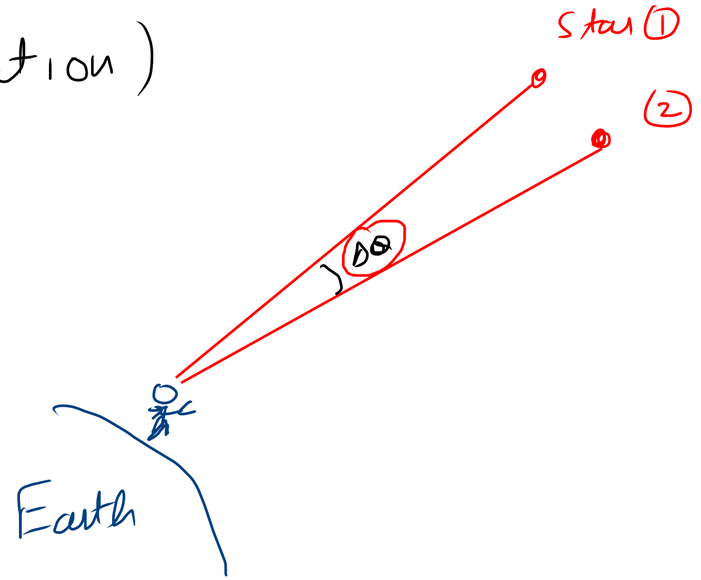


$$r_0 = (\Delta\theta) f$$

$$\frac{1.22\,\lambda f}{(2a)} = (\Delta\theta) f$$

$$\Delta\theta = \frac{1.22\,\lambda}{(2a)}$$

(2a) ↓ aperture



Minimum value of $\Delta\theta$ for which we can resolve two far away objects is called

"Limit of Resolution" of telescope

Diameter

Why is the apparture of a telescope is desired to be of larger size?

apparture/Diameter

$$\text{Resolving power of telescope} \propto \frac{1}{\Delta\theta} \propto \frac{2a}{1.22\lambda}$$

Microscope