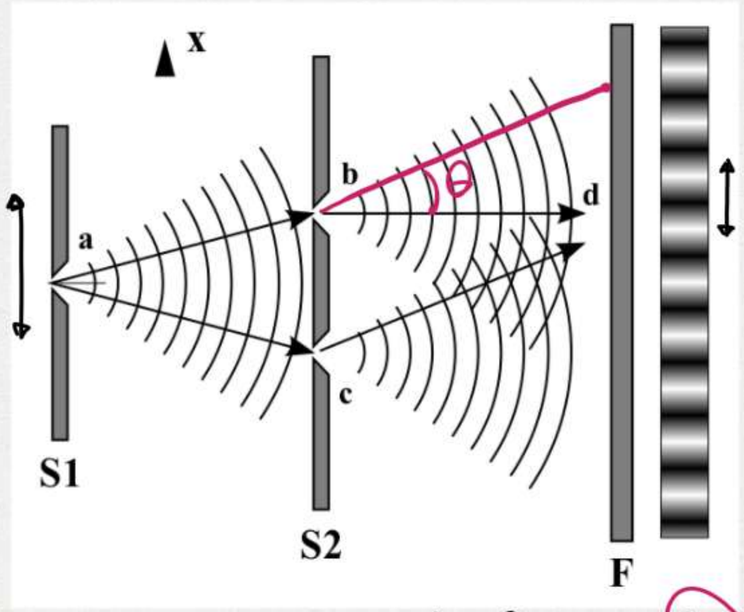
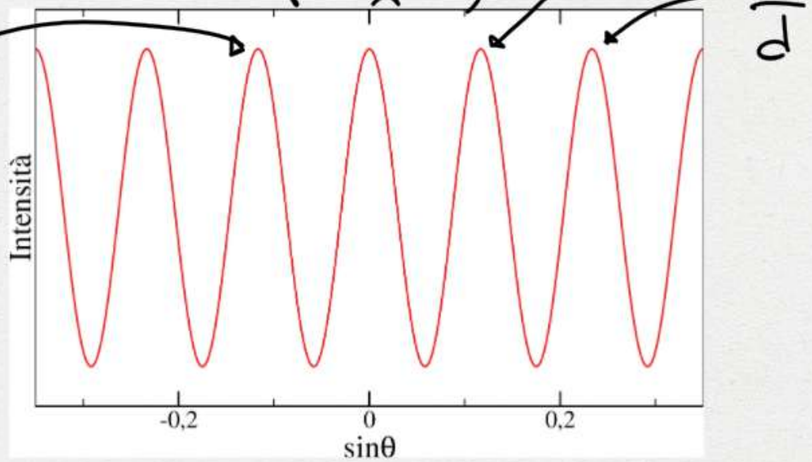
INTERFERENZA

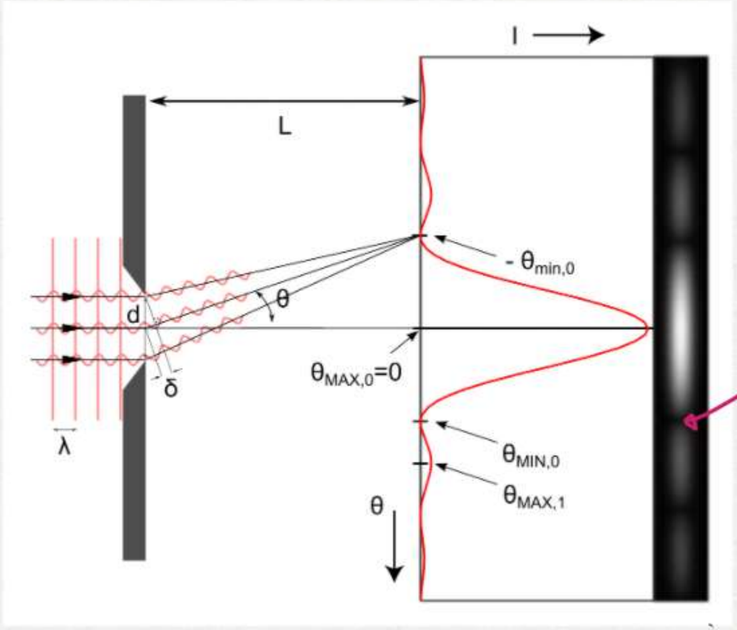


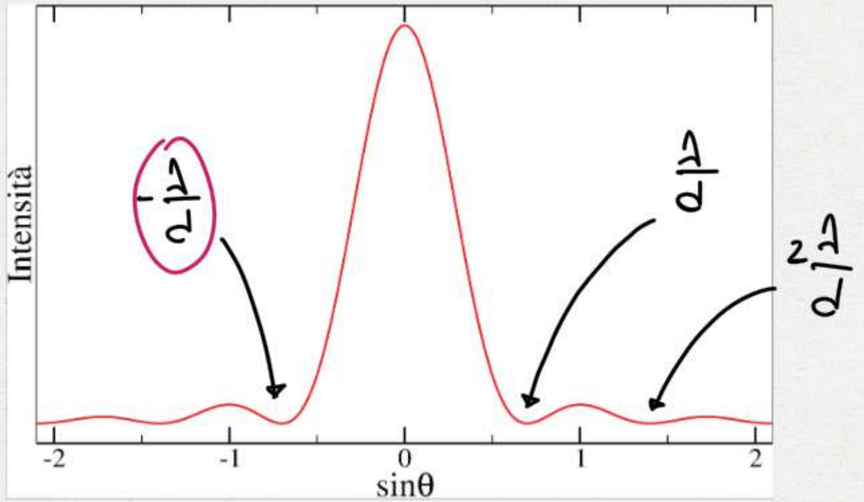
$$I(\theta) = 4 I_0 \cos^2\left(\frac{\pi d \sin\theta}{\lambda}\right)$$



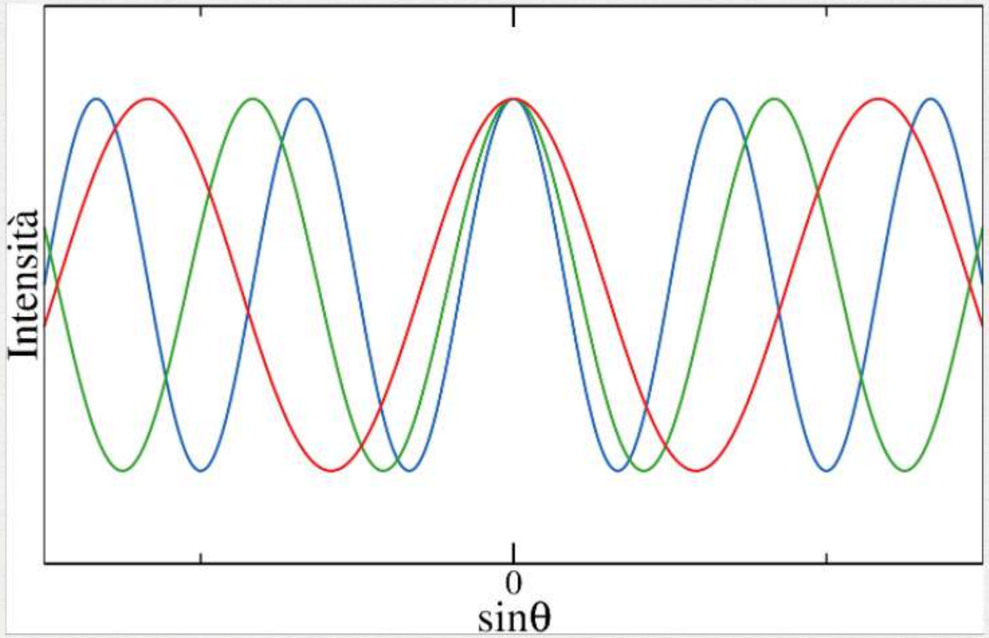
DIFFRAZIONE

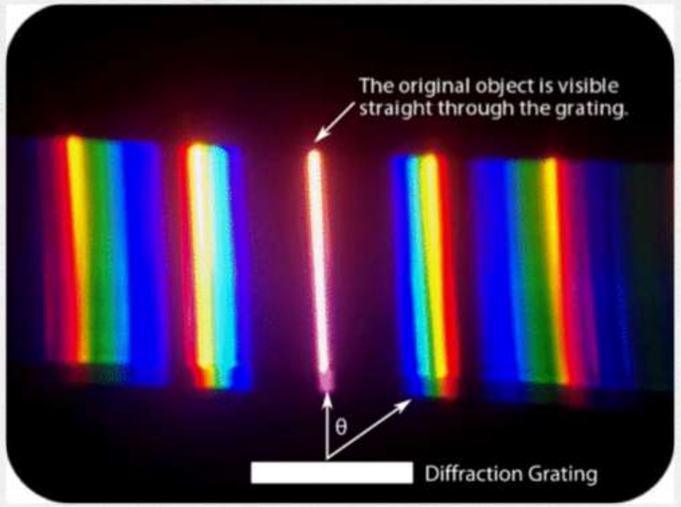
$$I(\theta) = I_0 \left[\frac{\sin\left(\frac{\pi d \sin\theta}{\lambda}\right)}{\frac{\pi d \sin\theta}{\lambda}}\right]^2$$

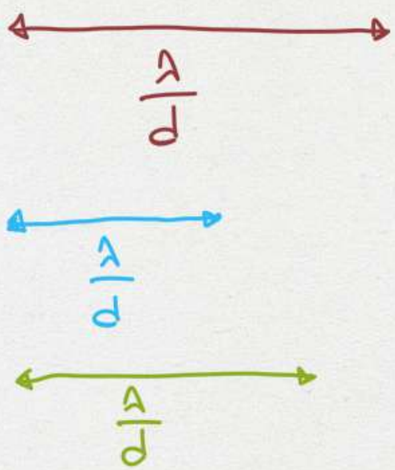


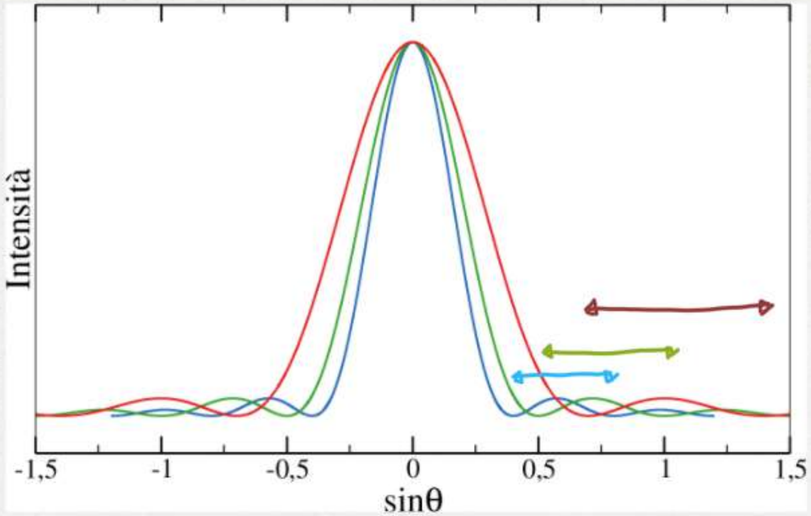


EFFETTI CROMATICI

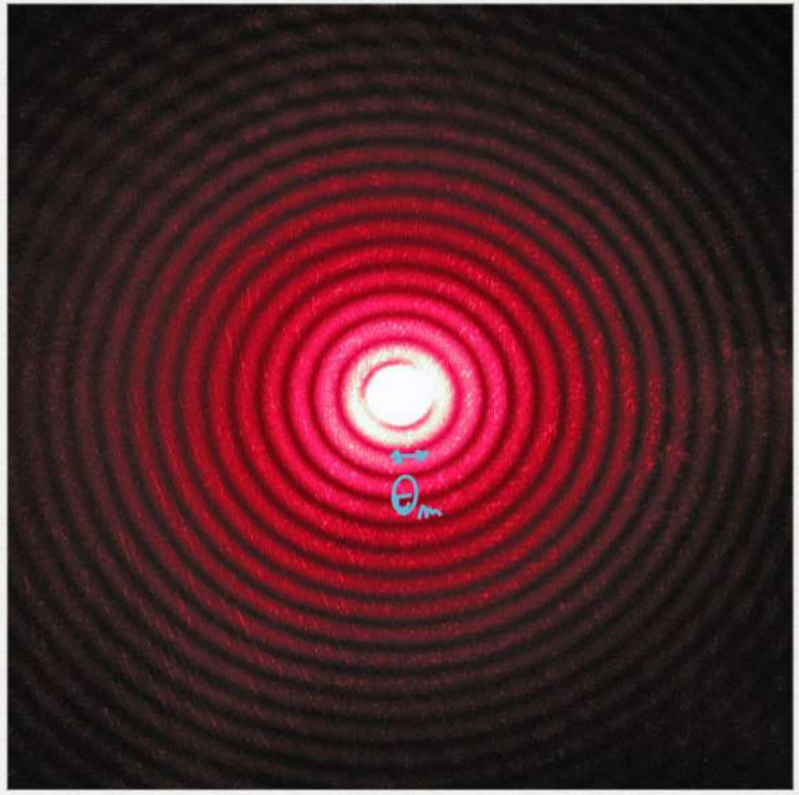








DIFFRAZIONE DA APERTURA CIRCOLARE

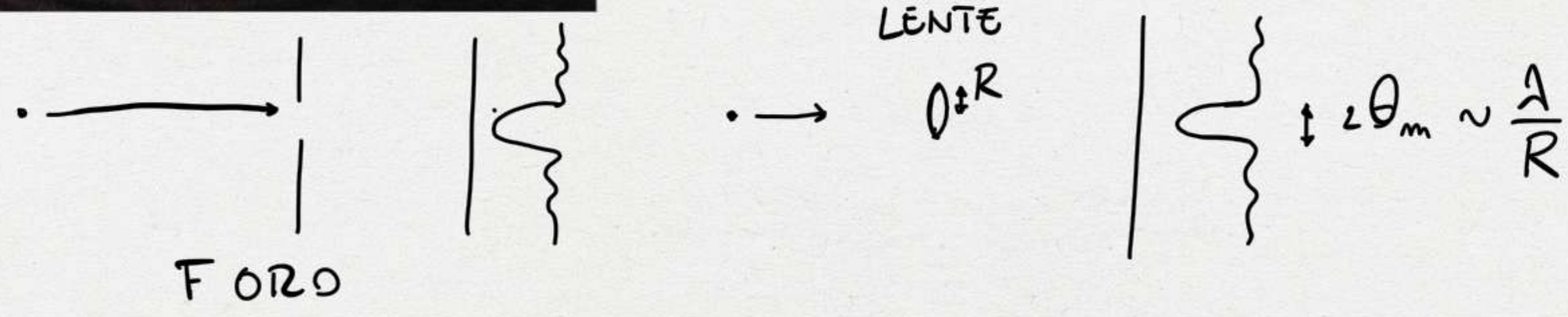


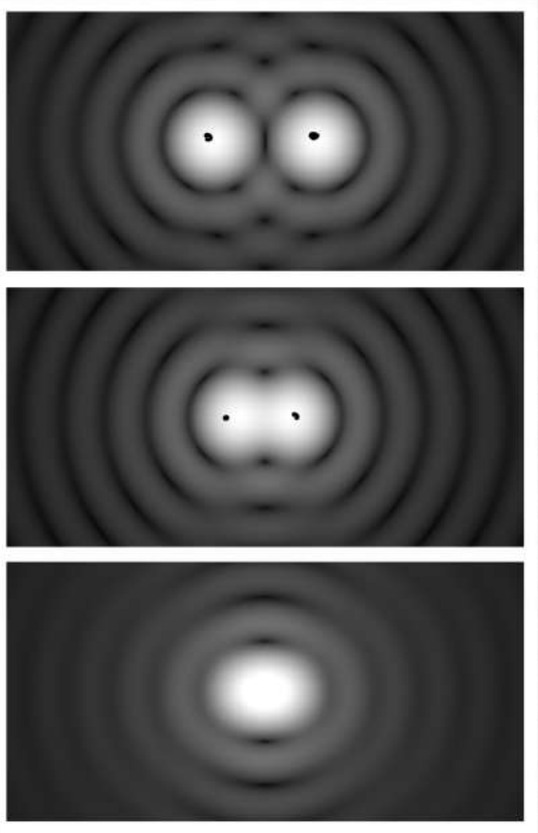
$\sin\theta_m = 0.61\,\frac{\lambda}{R}$, R raggio dell'apertura

$\downarrow$

$\sin\theta_m \approx \theta_m \approx 0.61\,\frac{\lambda}{R}$

$2\theta_m$ larghezza angolare del massimo centrale

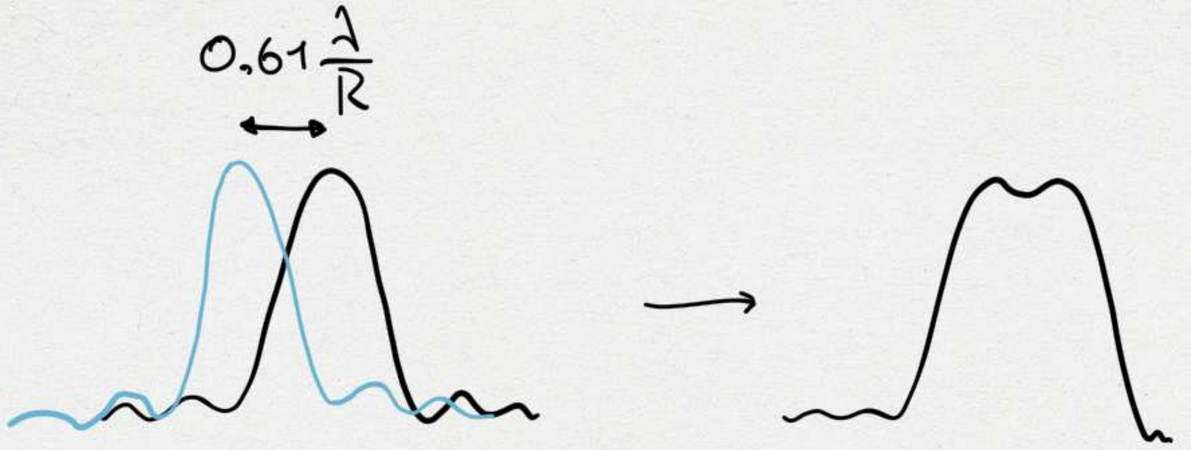




CRITERIO DI RAYLEIGH

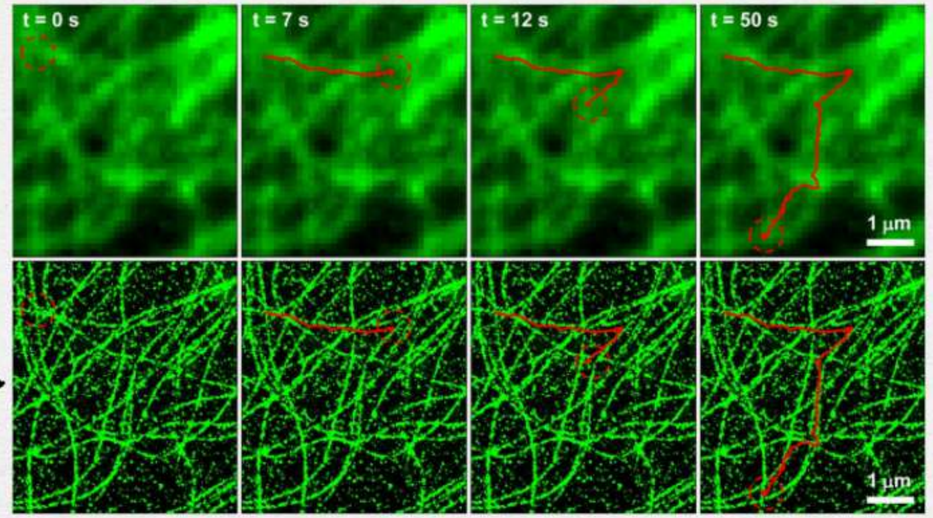
↓

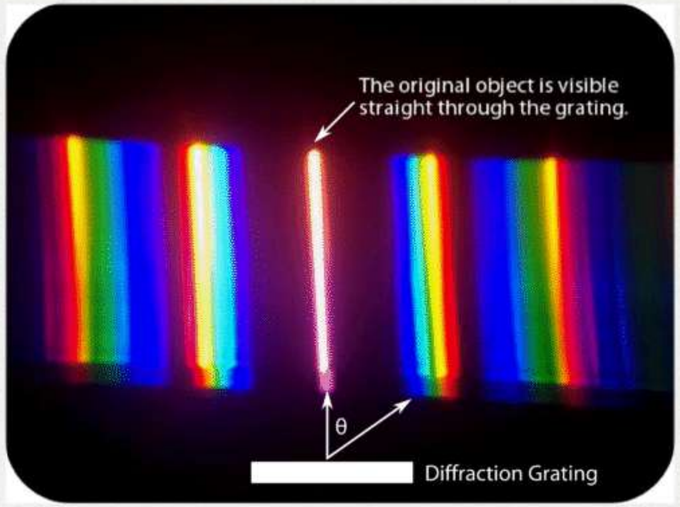
APPENA RISOLTI

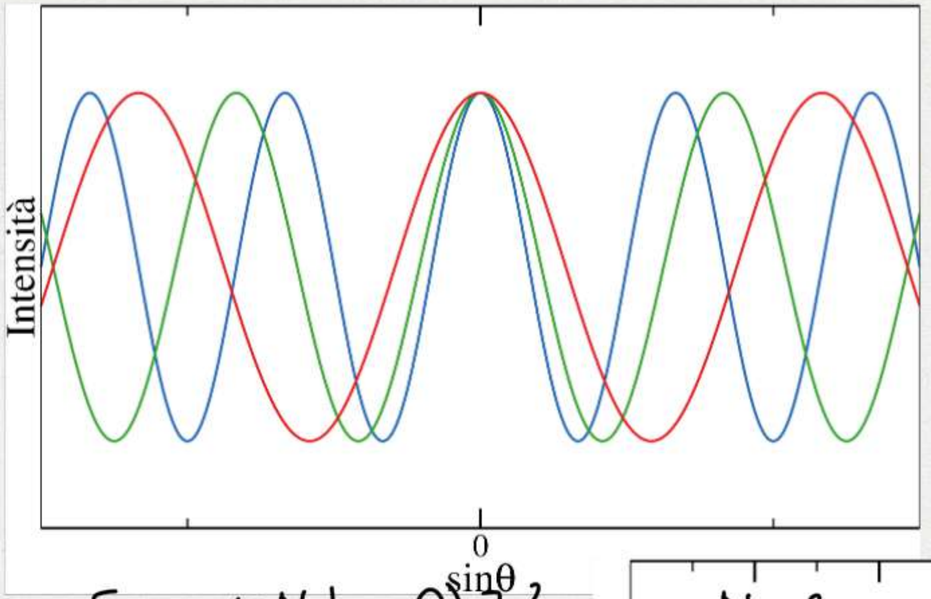


GLI OGGETTI NON SONO RISOLTI

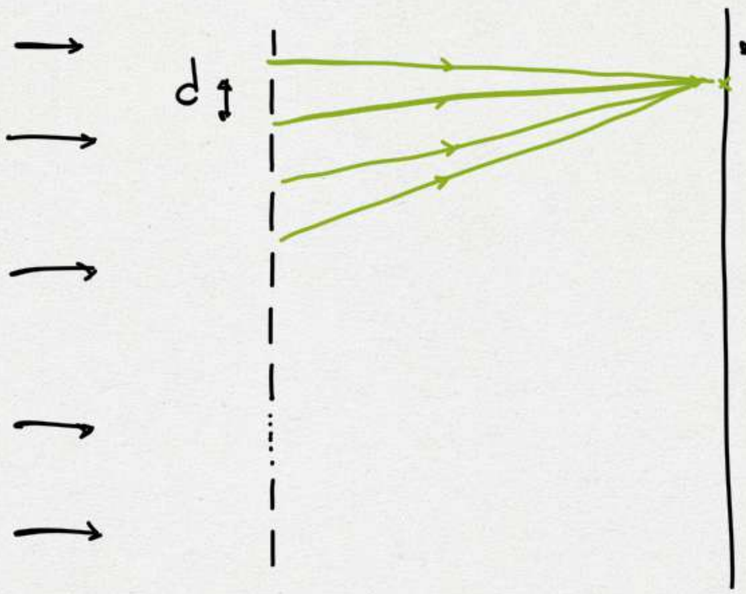
SUPER RESOLUTION MICROSCOPY



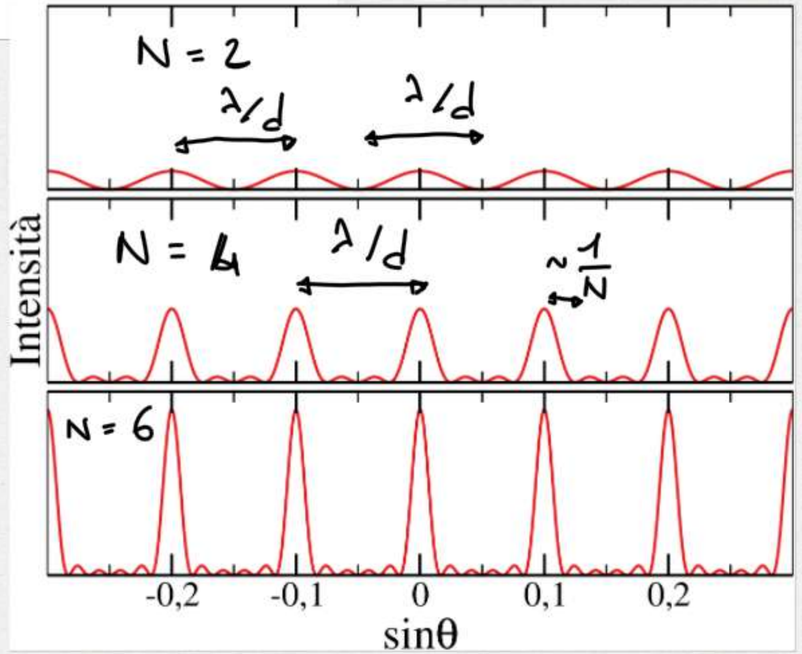


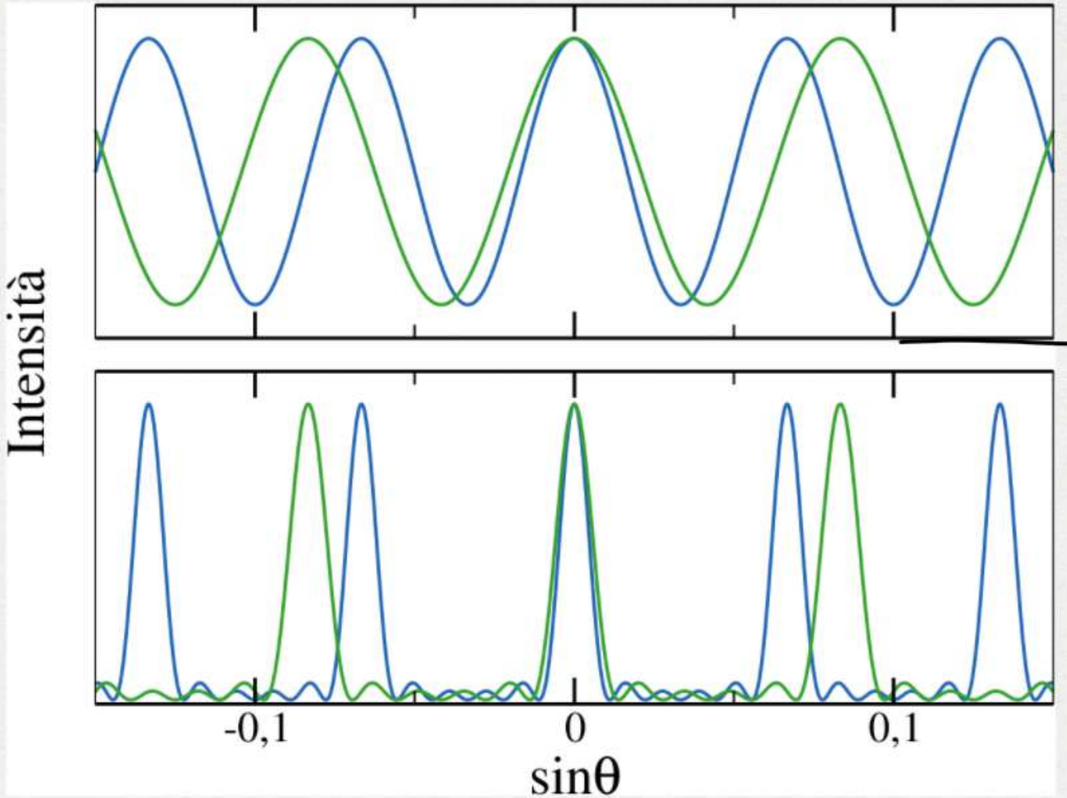


N FENDITURE



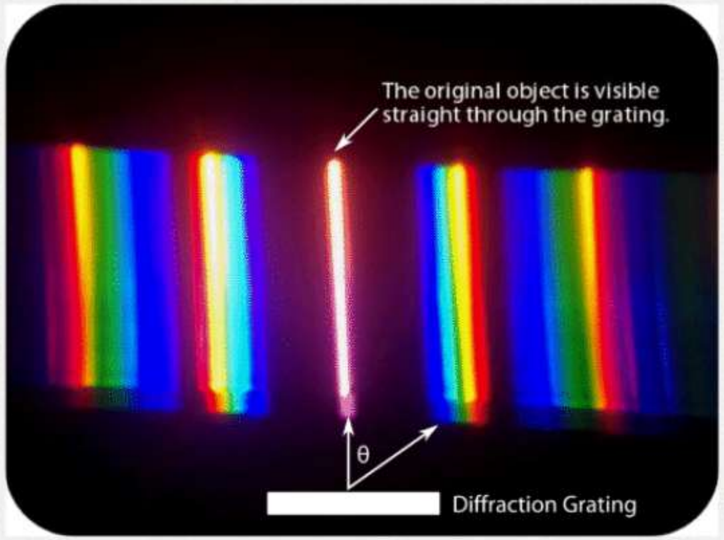
$$I(\theta) = \left[\frac{\sin\left(\frac{\pi N d \sin\theta}{\lambda}\right)}{\sin\left(\frac{\pi d \sin\theta}{\lambda}\right)} \right]^2$$





N = 2

N = 6



$I_M = N^2 I_0$ INTENSITÁ DEI MASSIMI PRINCIPALI

IL POTERE RISOLUTORE È

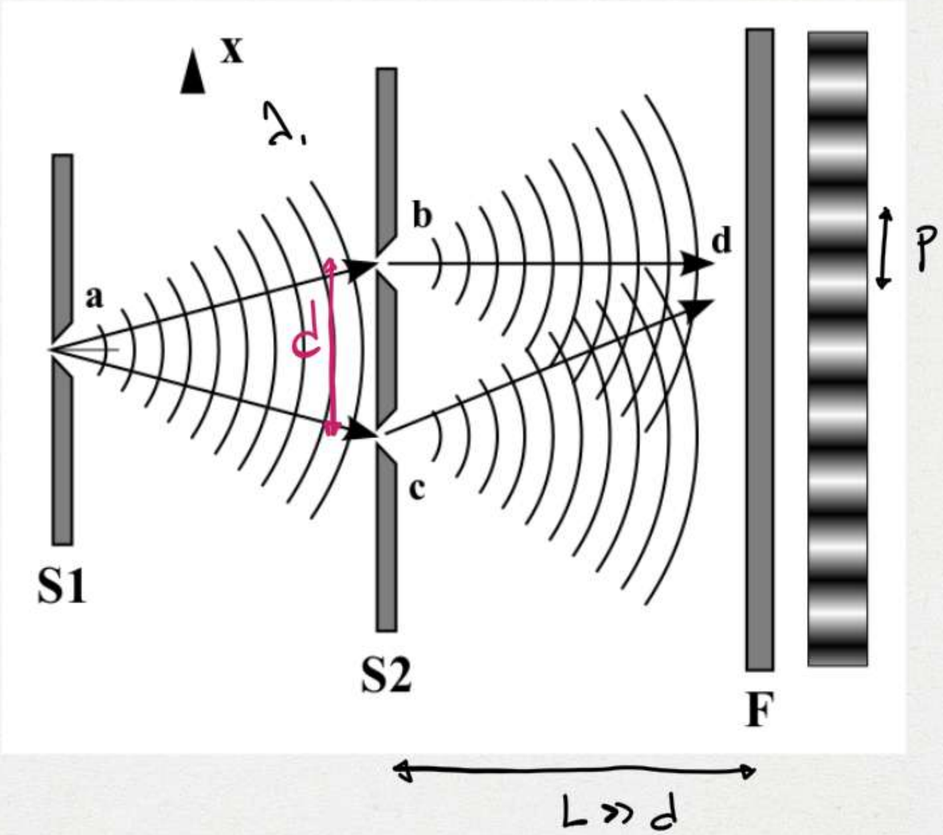
$$\frac{\Delta\lambda}{\lambda} \sim \frac{1}{N}$$

Es. 63

$\lambda_1 = 610$ nm

$p = 0.47$ mm distanza tra massimi adiacenti

$L = 77$ cm

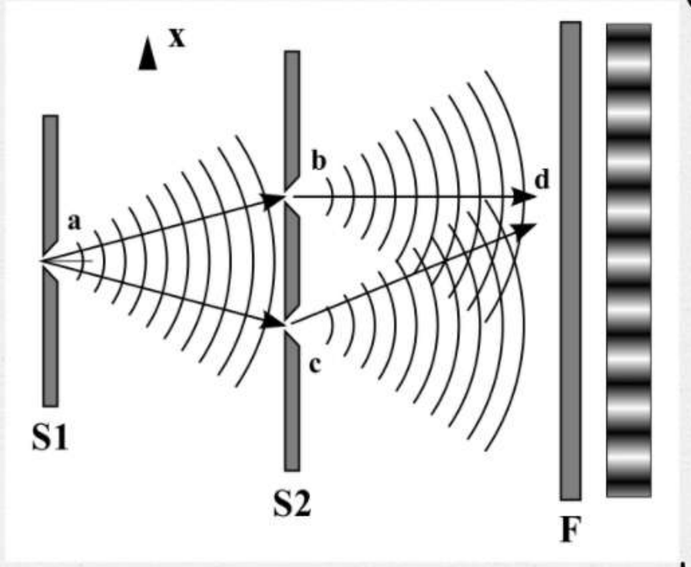


① calcolare d

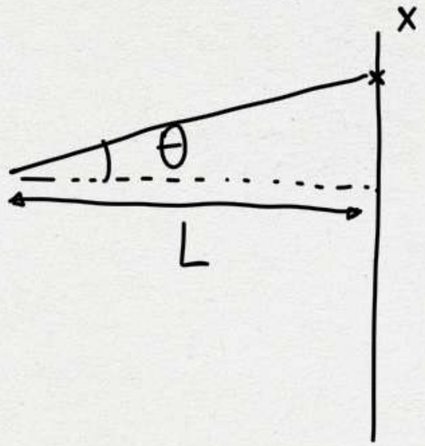
② per quale λ_2 si ha $p_2 = 0.91$ mm

③ determinare p_a se si immerge il dispositivo in acqua e si usa λ_1

④ in quest'ultimo caso qual è la densità delle frange?



① $\Delta\theta = \frac{\lambda}{d} \rightarrow \Delta\theta_1 = \frac{\lambda_1}{d}$



$x = L\,tg\theta \approx L\theta \Rightarrow$

$p = \Delta x_M = L\,\Delta\theta_M = \boxed{L\frac{\lambda_1}{d}} \Rightarrow$

$d = \frac{L\lambda_1}{p} = 1\ mm$

② $d = \frac{L\lambda}{p} \Rightarrow \lambda_2 = \frac{d\,p_2}{L} = 1.18\,\mu m = 1180\ nm$

③ $n_e = 1.33$, $v_e = \frac{c}{n_e}$, $v = \lambda\nu \Rightarrow \lambda_e = \frac{\lambda_1}{n_e} \Rightarrow$

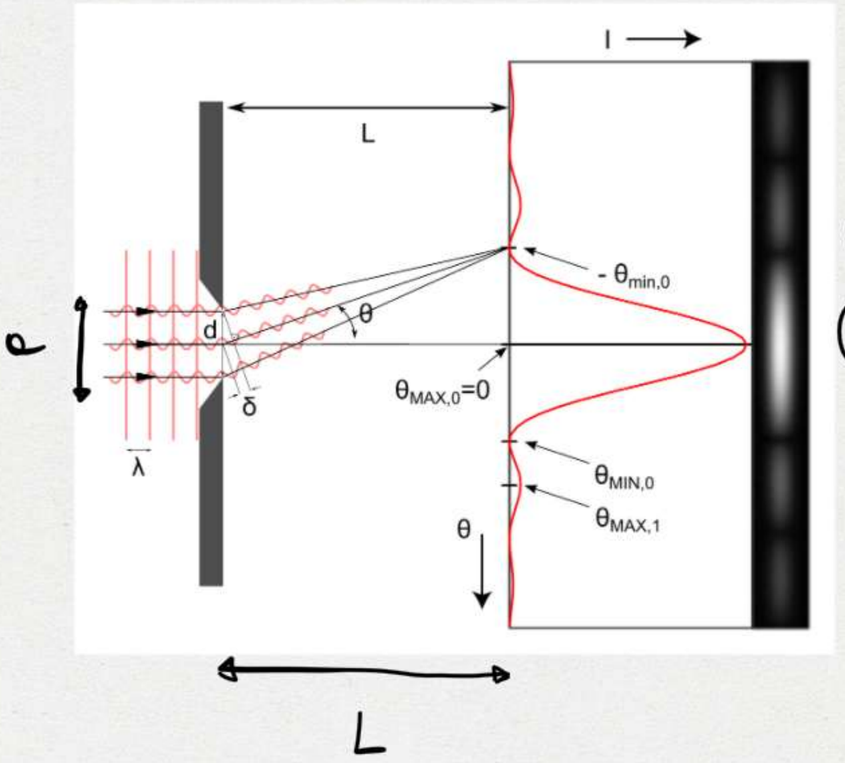
$p_e = \frac{\lambda_e L}{d} = \frac{\lambda_1 L}{n_e d} = \frac{p}{n_e} = 0{,}28\ mm$

④ $D_e = \frac{1}{p_e} = 3.5\ mm^{-1} = 35\ cm^{-1}$

ES. 64

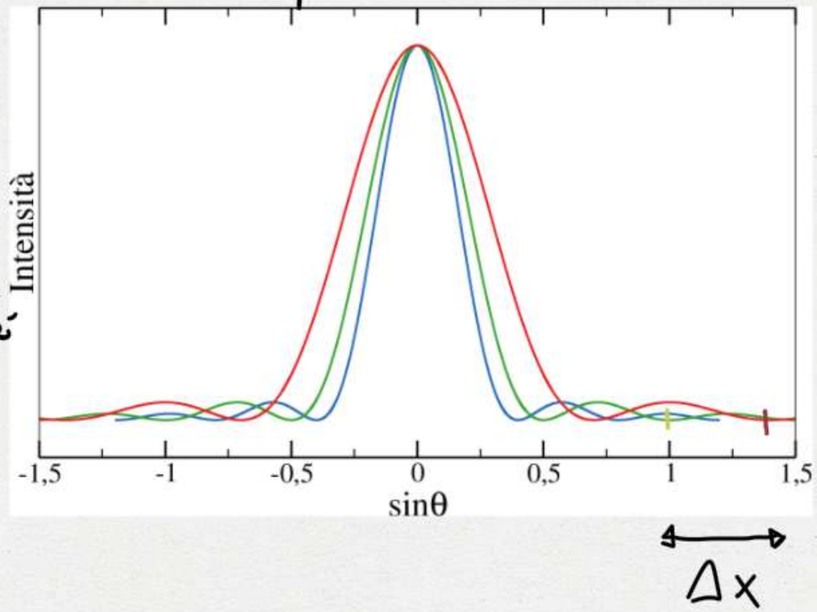
a larghezza della fenditura, $\lambda_1 = 350$ nm, $\lambda_2 = 450$ nm

$\Delta x = 6$ cm distanza tra i minimi di diffrazione del II ordine delle due componenti



① determinare a

② calcolare l'intensità relative delle due componenti per $\theta = 0$ sapendo che l'intensità relativa è pari a 0.06 per $\theta = \frac{\pi}{5}$



① $\sin\theta_m = \pm m \frac{\lambda}{a}$, $m \geq 1$

$x \approx L\theta \Rightarrow$

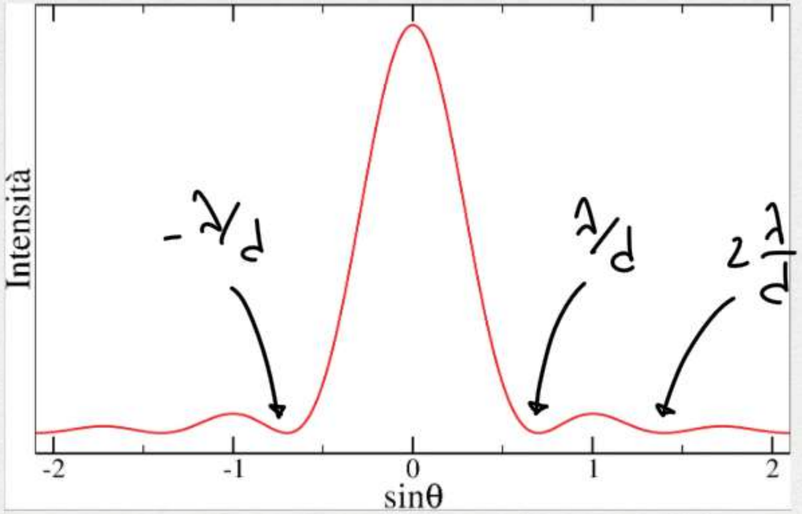
$\theta \approx \frac{x}{L} \Rightarrow$

$m = 2$

$\sin\theta_2 - \sin\theta_1 = 2\frac{\lambda_2}{a} - 2\frac{\lambda_1}{a} \approx$

$\approx \theta_2 - \theta_1 = \frac{x_2}{L} - \frac{x_1}{L} = \frac{\Delta x}{L} \Rightarrow$

$\frac{\Delta x}{L} = \frac{2(\lambda_2 - \lambda_1)}{a} \Rightarrow a = \frac{2(\lambda_2 - \lambda_1)L}{\Delta x} = 20\,\mu m$



② $I(\theta) = I(0)\left[\frac{\sin\left(\frac{\pi a \sin\theta}{\lambda}\right)}{\frac{\pi a \sin\theta}{\lambda}}\right]^2$ /

$\frac{I_1(\pi/5)}{I_2(\pi/5)} = 0.06 = \frac{I_1(0)}{I_2(0)}$ qui $\theta = \frac{\pi}{5}$

$\frac{\sin^2\left(\frac{\pi a \sin\theta}{\lambda_1}\right)}{\sin^2\left(\frac{\pi a \sin\theta}{\lambda_2}\right)} \frac{\lambda_1^2}{\lambda_2^2} \Rightarrow$

$\frac{I_1(0)}{I_2(0)} = 0.06 \frac{\sin^2\left(\frac{\pi a \sin\theta}{\lambda_2}\right)}{\sin^2\left(\frac{\pi a \sin\theta}{\lambda_1}\right)} \frac{\lambda_2^2}{\lambda_1^2} = 0.071$ $\theta = \frac{\pi}{5}$