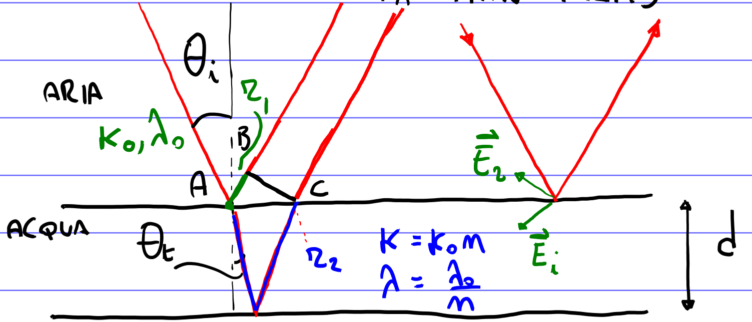
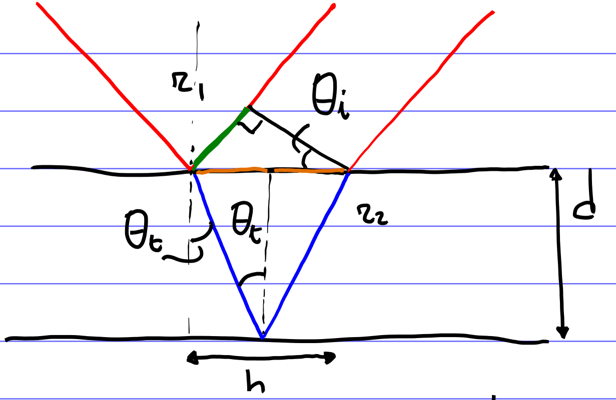
INTERFERENZA DA LAMINE SOTTILI

THIN FILMS



ARIA

$$\boxed{\delta} = \boxed{k r_2 - k_0 r_1} - \boxed{\pi} = k_0 m r_2 - k_0 r_1 - \pi = k_0 (m r_2 - r_1) - \pi$$



$$d = \frac{r_2}{2}\cos\theta_t \implies r_2 = \frac{2d}{\cos\theta_t}$$

$$r_1 = h \sin\theta_i$$

$$h = 2\,\frac{r_2}{2}\sin\theta_t = r_2 \sin\theta_t \implies$$

$$\sin\theta_i = n \sin\theta_t$$ SNELL

$$r_1 = r_2 \sin\theta_t \sin\theta_i = \frac{2d\sin\theta_t \sin\theta_i}{\cos\theta_t} =$$

$$= \frac{2dn\sin^2\theta_t}{\cos\theta_t} \implies \delta = k_0 n r_2 - k_0 r_1 - \pi = \boxed{\frac{k_0 n 2d}{\cos\theta_t}} - \boxed{\frac{k_0 n 2d \sin^2\theta_t}{\cos\theta_t}} - \pi =$$

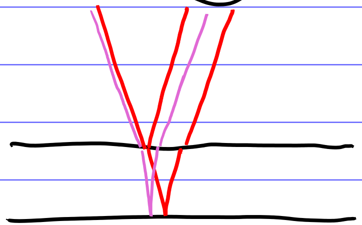
$$= \frac{2k_0 n d}{\cos\theta_t}\underbrace{(1-\sin^2\theta_t)}_{\cos^2\theta_t} - \pi \implies \delta = 2k_0 n d\cos\theta_t - \pi = \frac{4\pi n d\cos\theta_t}{\lambda_0} - \pi$$

m è un intero

$\rightarrow \delta = 2m\pi \longrightarrow$ interferenza costruttiva $\rightarrow$ vediamo l'onda

$\rightarrow \delta = (2m+1)\pi \rightarrow$ interferenza distruttiva $\rightarrow$ non vediamo l'onda

$$\delta = \frac{4\pi n d}{\lambda_0} \cos\theta_t - \pi \approx \frac{4\pi n d}{\lambda_0} - \pi$$



DNA

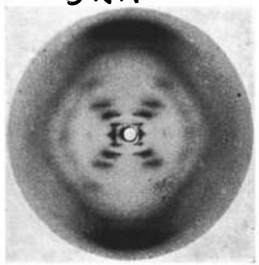
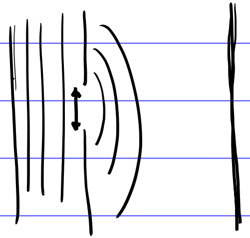
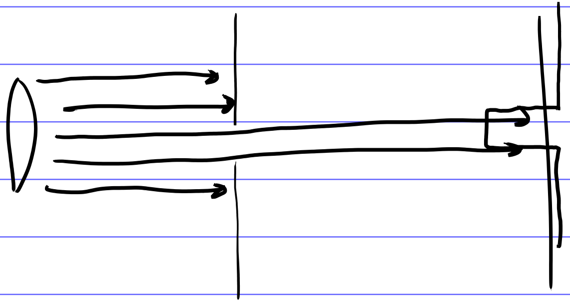


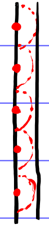
FIGURA (PATTERN) DI <u>DIFFRAZIONE</u> DI RAGGI X

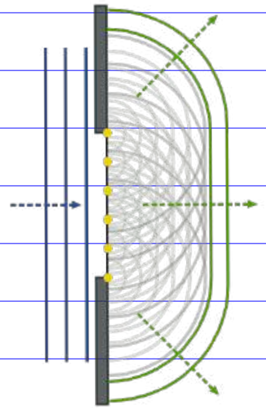




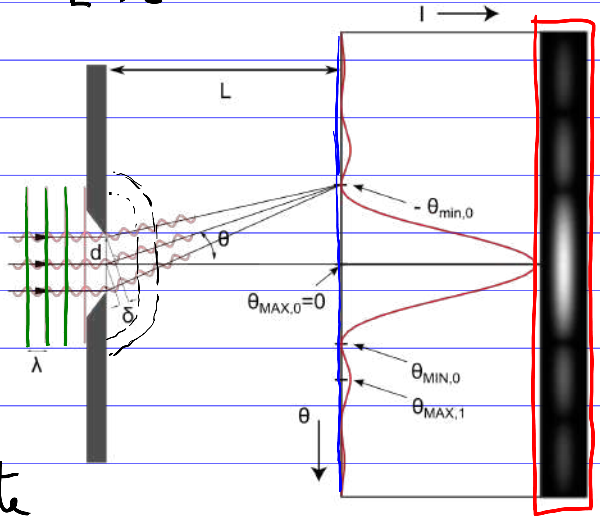
la luce è un'onda!
(in verità sarebbe giusto dire che si <u>comporta</u> come un'onda in questo contesto)

PRINCIPIO DI HUYGENS-FRESNEL

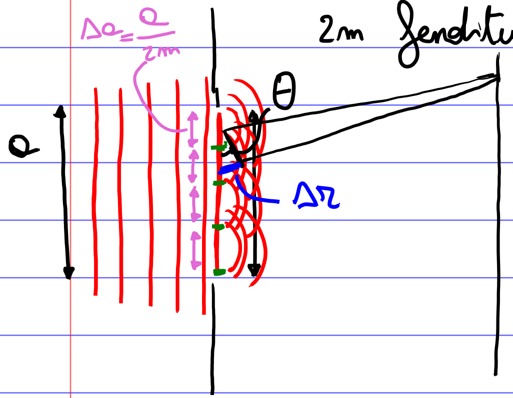




$L \gg d$



Consideriamo esperimenti fatti nel regime di Fraunhofer: si ha quando sorgente e schermo sono <u>molto</u> distanti dalla fessura

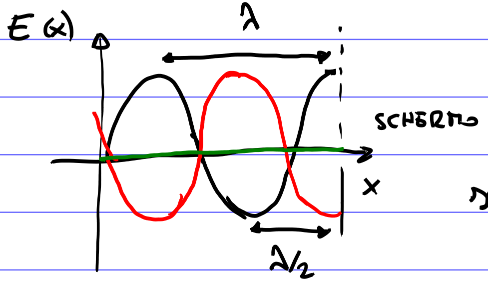


$2m$ fenditure, $m \geq 1$ è un intero

$$\Delta a = \frac{a}{2m}$$

$$\Delta r = \Delta a \sin\theta = \frac{a}{2m} \sin\theta$$

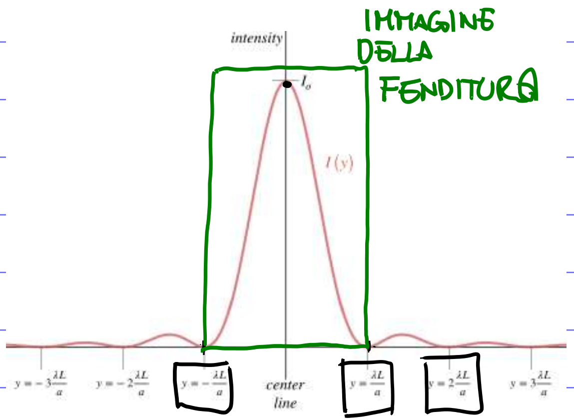
due onde "virtuali" fanno interferenza distruttiva quando $\Delta r = \frac{\lambda}{2} \Rightarrow$



$$\frac{\lambda}{2} = \frac{a}{2m} \sin\theta \Rightarrow \sin\theta = \frac{m\lambda}{a}$$, con $m \geq 1$ intero

svolgendo i calcoli ...

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

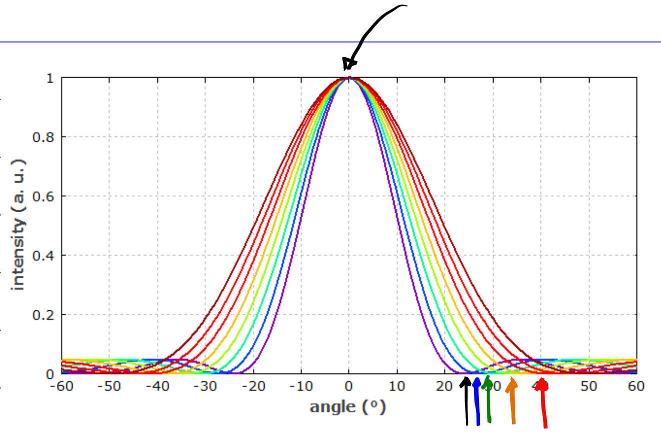


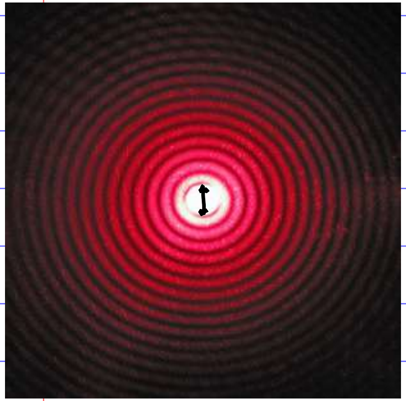
i minimi appaiono per $\sin\theta = \frac{m\lambda}{a}$

in questo caso $x = L\sin\theta \approx L\theta$

i minimi appaiono per $x = m\frac{\boxed{\lambda}\boxed{L}}{\boxed{a}}$

$$\sin\theta = \frac{m\lambda}{a} \longrightarrow x \approx \frac{m\lambda L}{a}$$



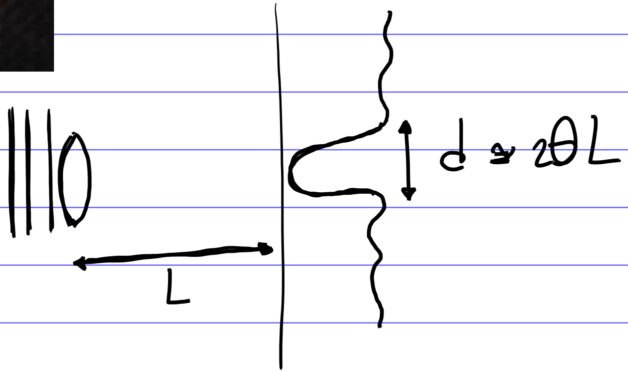


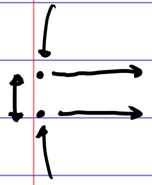
se il foro ha raggio R

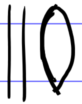
$$\sin\theta = 0.61\,\frac{\lambda}{R} \approx \theta$$

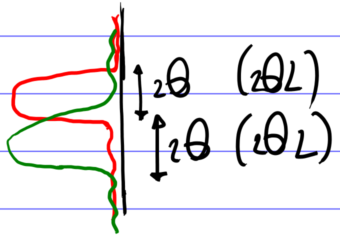
2θ è la dimensione dell'immagine della fenditura

•))



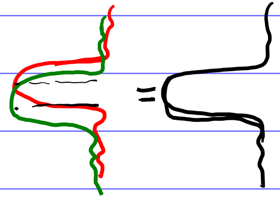






$$\boxed{\alpha_{min} = 0.61 \frac{\lambda}{R}}$$

LIMITE DI DIFFRAZIONE



SCRITTO 26/01

$\boxed{11-13}$

ORALE 02-03/02