Laboratório de Mecânica Oscilações e Ondas

Difracção

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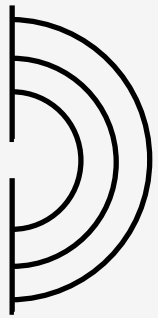
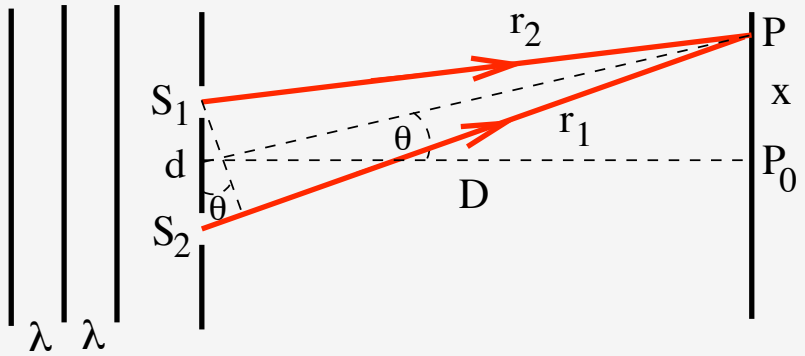
Difracção

Cópia das transparências

Interferência de Young

Fonte luminosa pontual





$$E_1 = E_0 \sin(\omega t - k r_1)$$

$$E_2 = E_0 \sin(\omega t - k r_2)$$

$$\Delta = r_1 - r_2 \simeq d \sin\theta$$

$$I \propto (E_1 + E_2)^2 \sim 4E_0^2 \cos^2\left(\frac{\delta}{2}\right)$$

$$\delta = k\Delta = \frac{2\pi}{\lambda} d \sin\theta$$

$$I_{max} \Rightarrow \frac{\delta}{2} = m\pi$$

Máximos para

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

Difracção por uma fenda

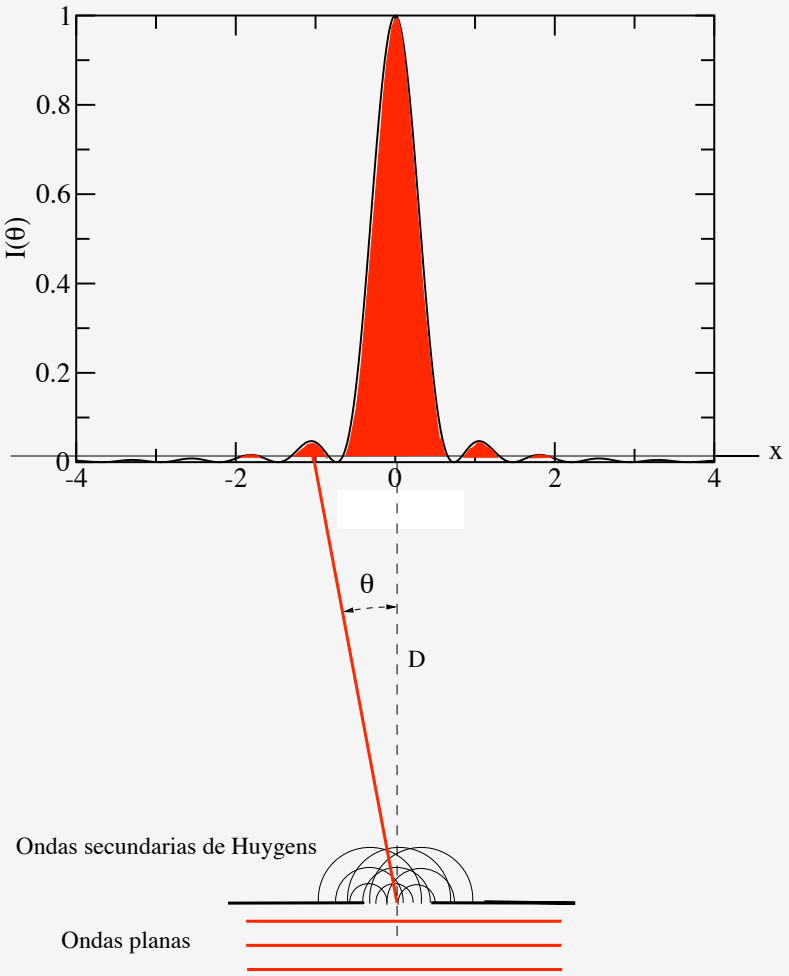
fenda de Largura S

$$I(\theta) = \left(\frac{\sin u}{u} \right)^2$$

$$u = \frac{\pi S}{\lambda} \sin \theta$$

Nulos $\rightarrow u = m\pi$

$$S \sin \theta = n\lambda$$



Difracção por N fendas: Rede de difracção

N fendas de Largura S
espaçadas de a

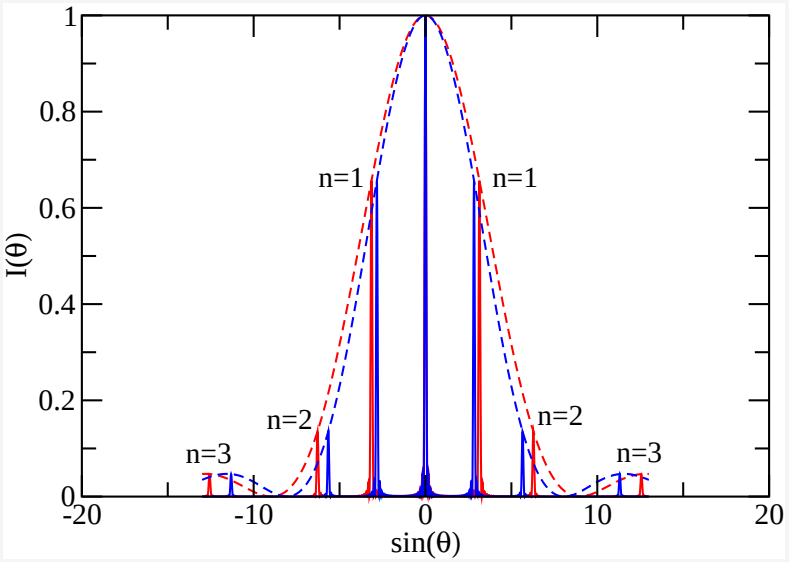
$$I(\theta) = \left(\frac{\sin u}{u}\right)^2 \left(\frac{\sin(Nv)}{N \sin v}\right)^2$$

$$u = \frac{\pi S}{\lambda} \sin\theta$$

$$v = \frac{\pi a}{\lambda} \sin\theta$$

Nulos $\rightarrow u = m\pi$

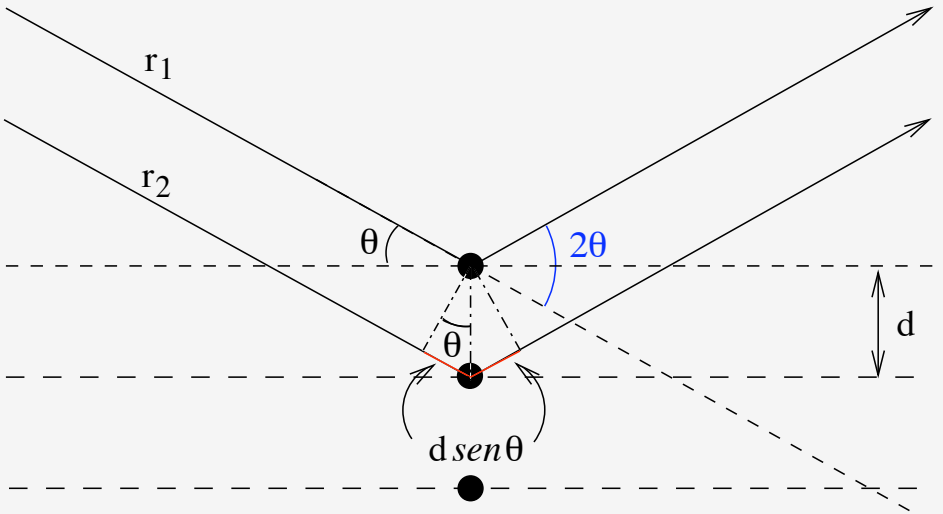
$$S \sin\theta = m\lambda$$



Máximos $\rightarrow v = n\pi$

$$a \sin\theta = n\lambda$$

Lei de Bragg



$$\delta = k(r_1 - r_2) = 2 \times \frac{2\pi}{\lambda} d \sin\theta$$

$$I_{max} \Rightarrow \frac{\delta}{2} = n\pi$$

Máximos para

$$2d \sin\theta = n\lambda$$

Difracção de electrões

Hipótese de De Broglie

$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

$$qU_a a = \frac{1}{2}mv^2$$

$$2qmU_a = m^2v^2 = p^2$$

$$p = \sqrt{2qmU_a}$$

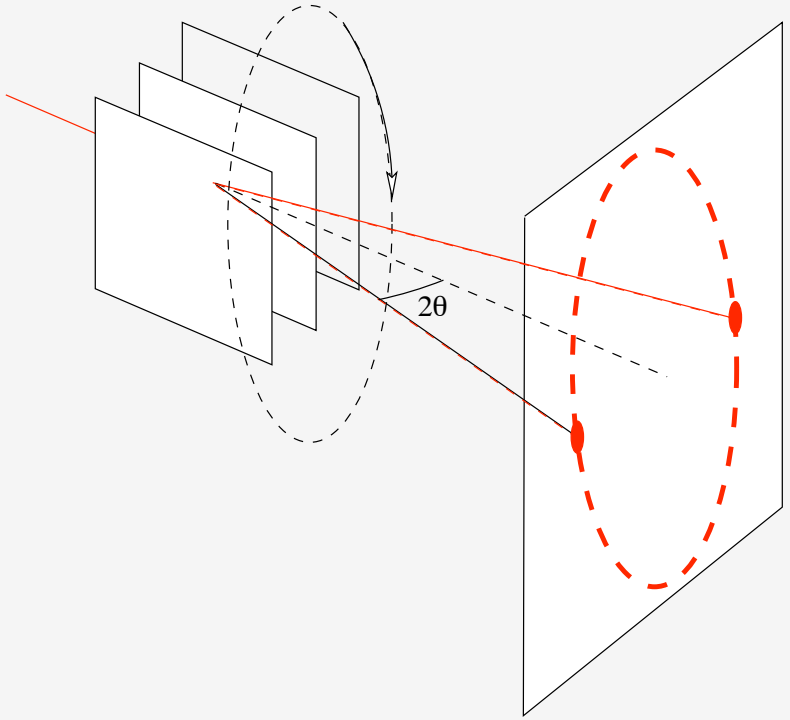
$$\lambda_{De\ Broglie} = \frac{h}{\sqrt{2qmU_a}} \simeq$$

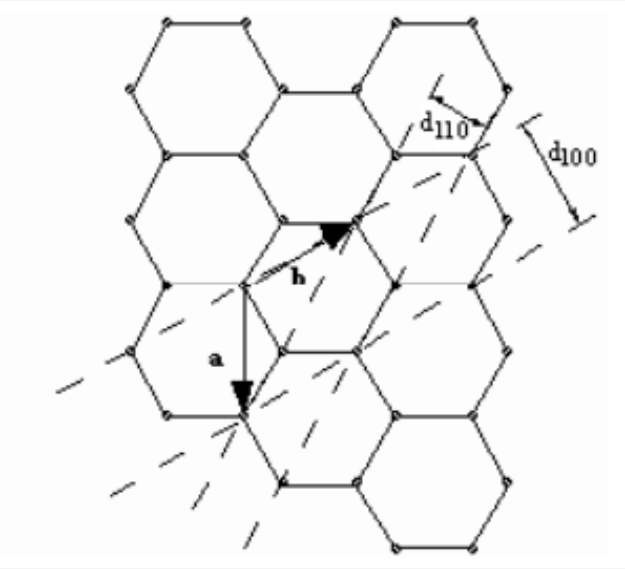
$$\simeq \frac{1.23 \times 10^{-9}}{\sqrt{U_a}} m$$

Experimentalmente

$$\lambda_{exp} = 2d \sin\theta$$

Grafite





$$d_{10} = 0.213 \times 10^{-9} m$$
$$d_{11} = 0.123 \times 10^{-9} m$$

Índices de Miller