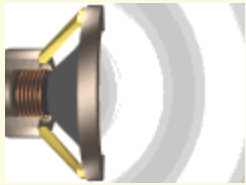
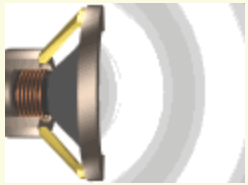


Aula 21: Mecânica Ondulatória

1. Função de onda associada
2. Equação de Schrödinger
3. Difracção de electrões
4. Princípio de Heisenberg
5. Probabilidade de localização

Simulação: função de onda do electrão

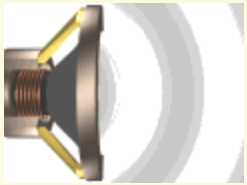


1. Função de onda associada

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

$$\hbar\omega = \frac{mv^2}{2} + \text{const.}$$

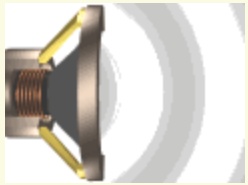
$$\Psi = A\,sen(kx - \omega x) = A\,sen\left(\frac{p}{\hbar}x - \frac{E}{\hbar}t\right)$$



2. Equação de Schrödinger

$$\frac{\partial^2\Psi}{\partial x^2} = \frac{1}{v^2}\frac{\partial^2\Psi}{\partial t^2} \quad \Rightarrow \quad \frac{\partial^2\Psi}{\partial x^2} + \frac{2m}{\hbar^2}(E-U)\Psi = 0$$

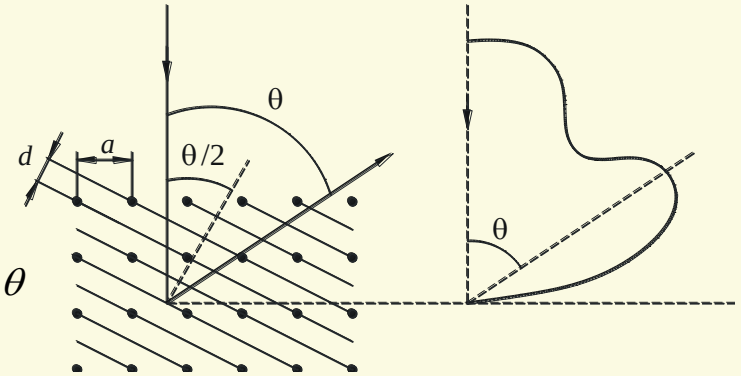
Simulação: difracção de electrões

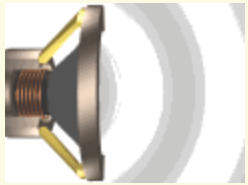


3. Difracção de electrões

$$\lambda = \frac{h}{\sqrt{2m_e\varepsilon}} = \frac{h}{\sqrt{2m_e eV}} = \sqrt{\frac{1.5}{V}} \quad (\text{nm})$$

$$m\lambda = 2\frac{d}{\cos(\theta/2)} - 2d\tan\left(\frac{\theta}{2}\right)\sin\left(\frac{\theta}{2}\right) = 2d\cos\left(\frac{\theta}{2}\right) = a\sin\theta$$

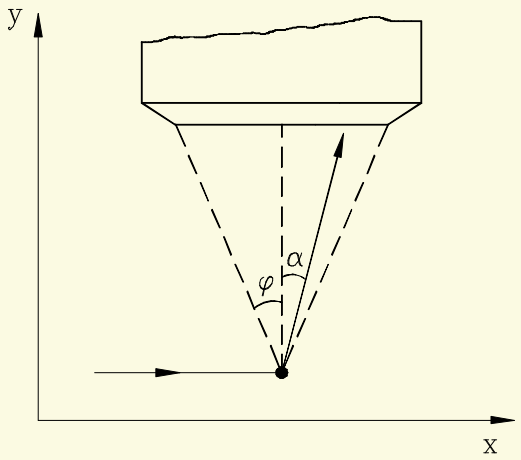


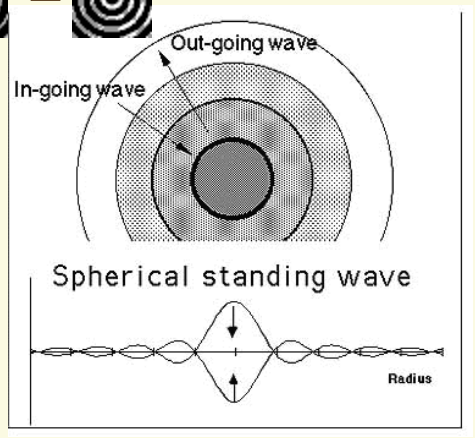


4. Princípio de Heisenberg

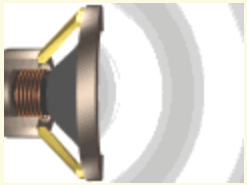
$$\Delta x \Delta p_x \geq \frac{\hbar}{2}$$

$$\Delta E \, \Delta t \geq \frac{\hbar}{2}$$

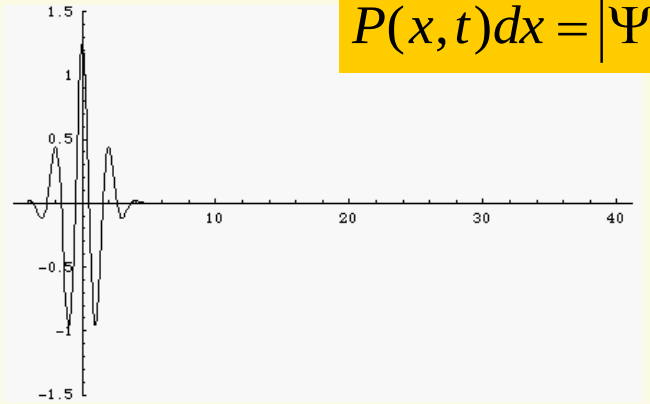




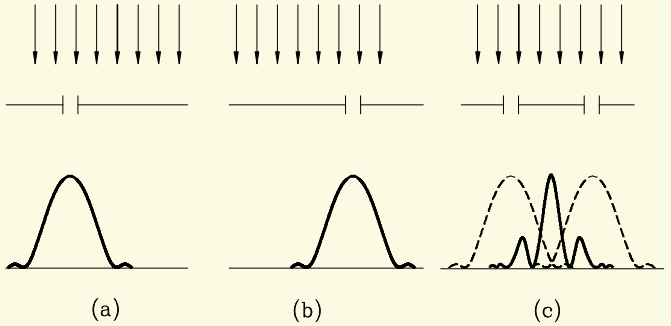
Localização de electrões: animação



5. Probabilidade de localização



$$P(x,t)dx = |\Psi(x,t)|^2 dx$$



$$|\Psi_{12}|^2 = |\Psi_1|^2 + |\Psi_2|^2 + 2Re(\Psi_1^* \Psi_2)$$