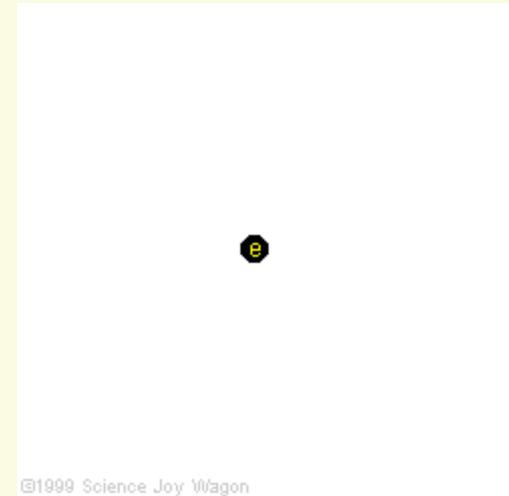


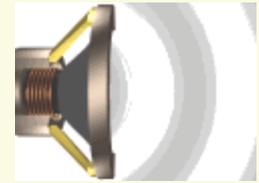
Aula 19: Fotões

1. Fotão
2. Efeito fotoelétrico
3. Efeito de Compton

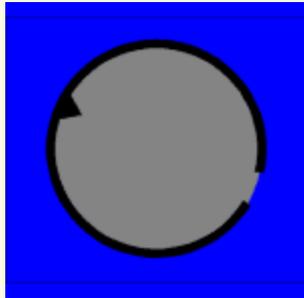


Simulação: radiação térmica

Ondas e fotões (RM): animação



1. Fotão



$$E = h\nu$$

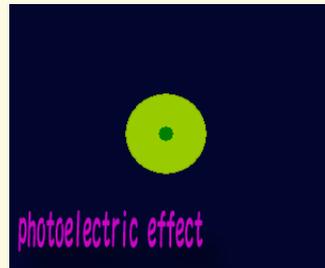
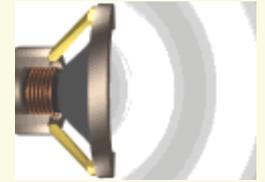
$$p = \frac{E}{c} = \frac{h\nu}{c} = \frac{h}{\lambda}$$

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

$$p^2 = \frac{m_0^2 v^2}{1 - v^2/c^2} \quad \text{or} \quad \frac{v^2}{c^2} = \frac{p^2}{p^2 + m_0^2 c^2} \quad \text{i.e.,} \quad \gamma = \sqrt{1 + \frac{p^2}{m_0^2 c^2}}$$

$$E = m_0 c^2 \sqrt{1 + \frac{p^2}{m_0^2 c^2}} \quad \text{or} \quad E^2 = p^2 c^2 + (m_0 c^2)^2$$

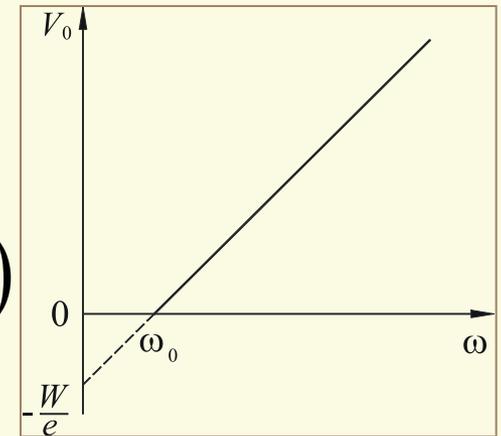
Simulação: efeito fotoelétrico



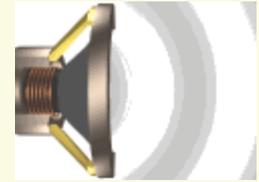
$$\frac{mv^2}{2} = \varepsilon - W$$

$$eV_0 = \hbar\omega - W = \hbar(\omega - \omega_0)$$

2. Efeito fotoelétrico



Efeito de Compton: animação



3. Efeito de Compton

$$\varepsilon + m_e c^2 = \varepsilon' + \left(p_e^2 c^2 + m_e^2 c^4 \right)^{1/2}$$

$$\vec{p} = \vec{p}' + \vec{p}_e$$

$$\lambda' - \lambda = \Lambda_0 (1 - \cos \theta)$$

