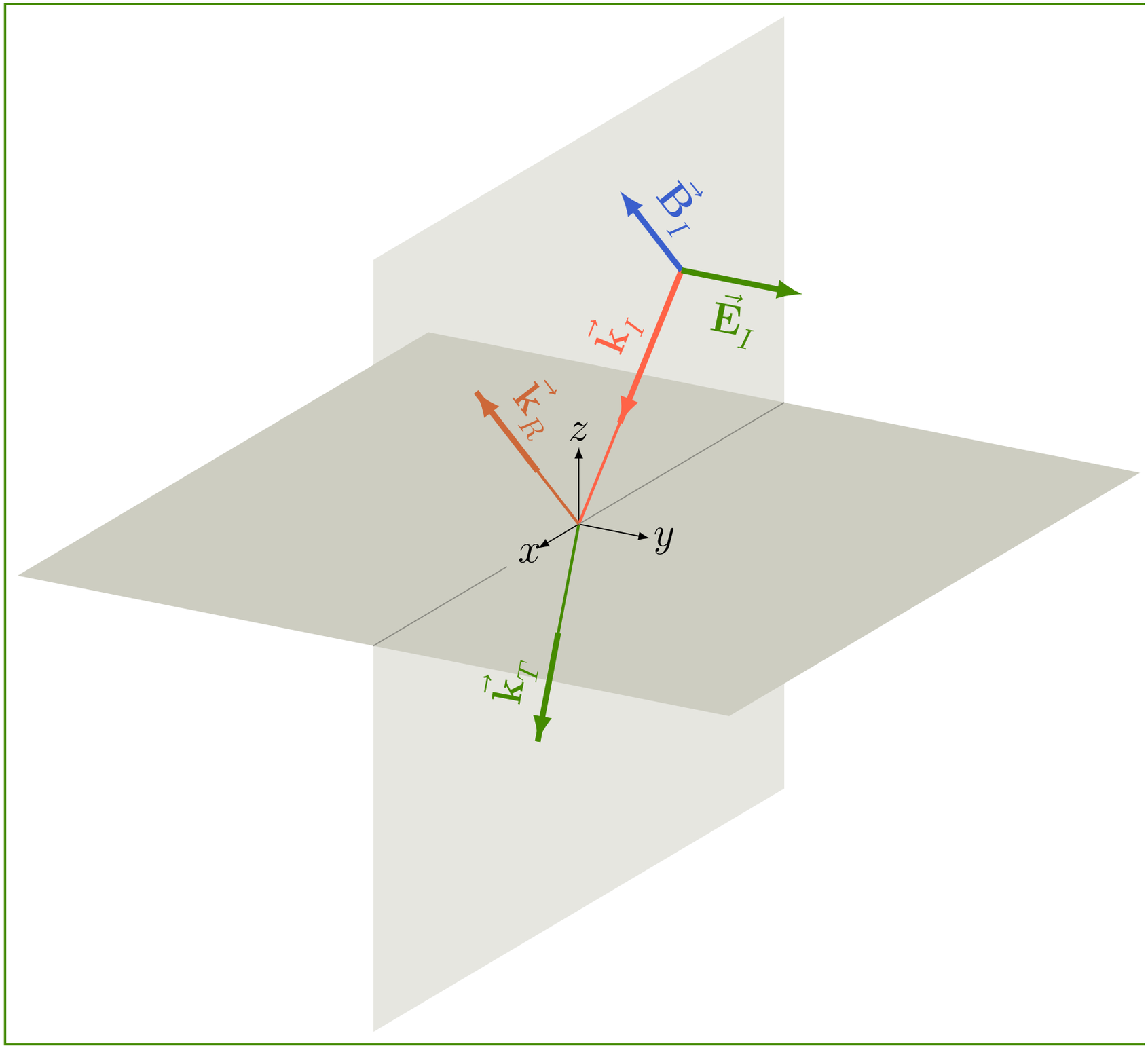
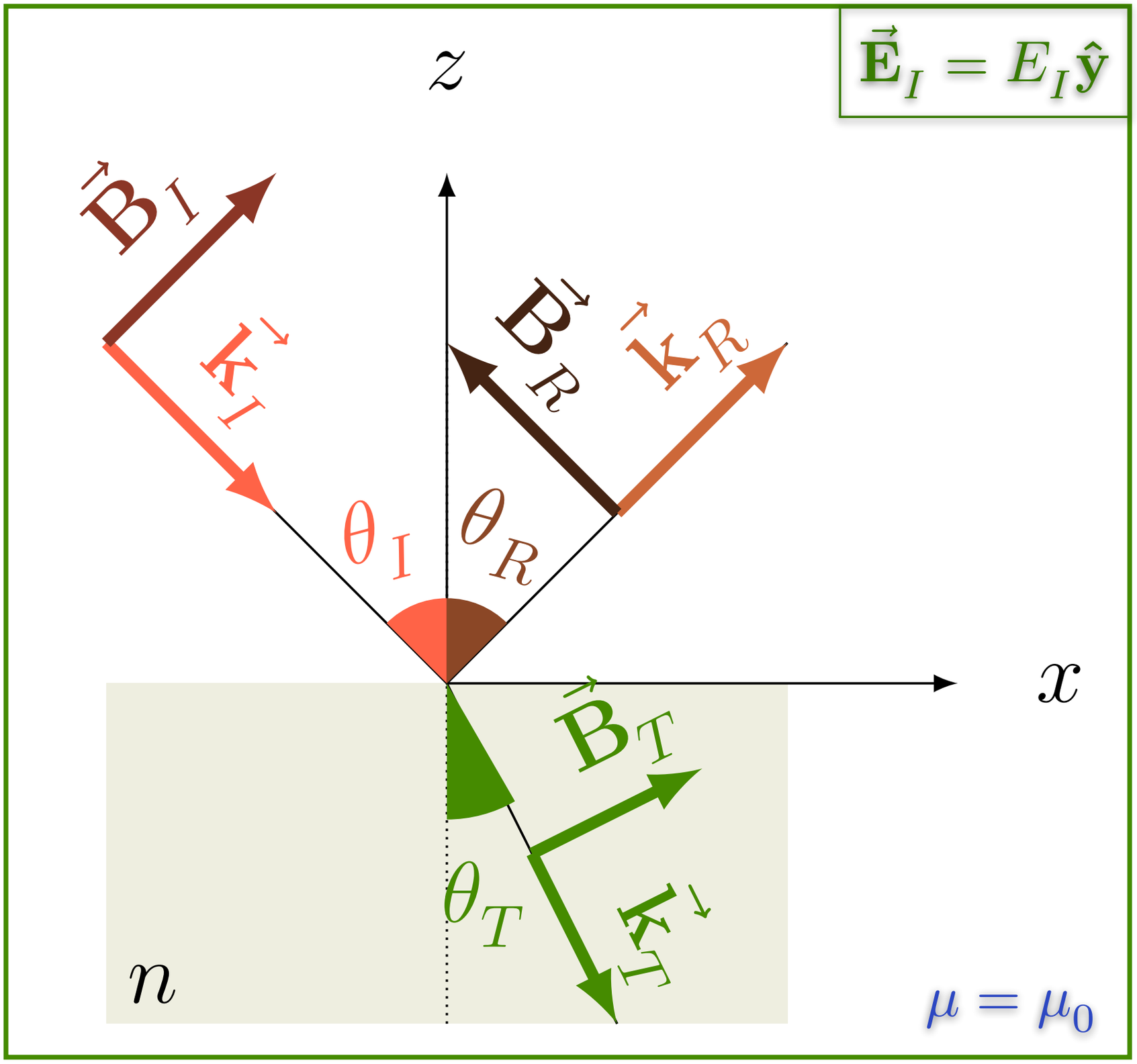
Eletromagnetismo Avançado

22 de setembro
Ondas Eletromagnéticas

Equações de Fresnel: $\overrightarrow{B}$ paralelo



Equações de Fresnel: $\overrightarrow{B}$ paralelo

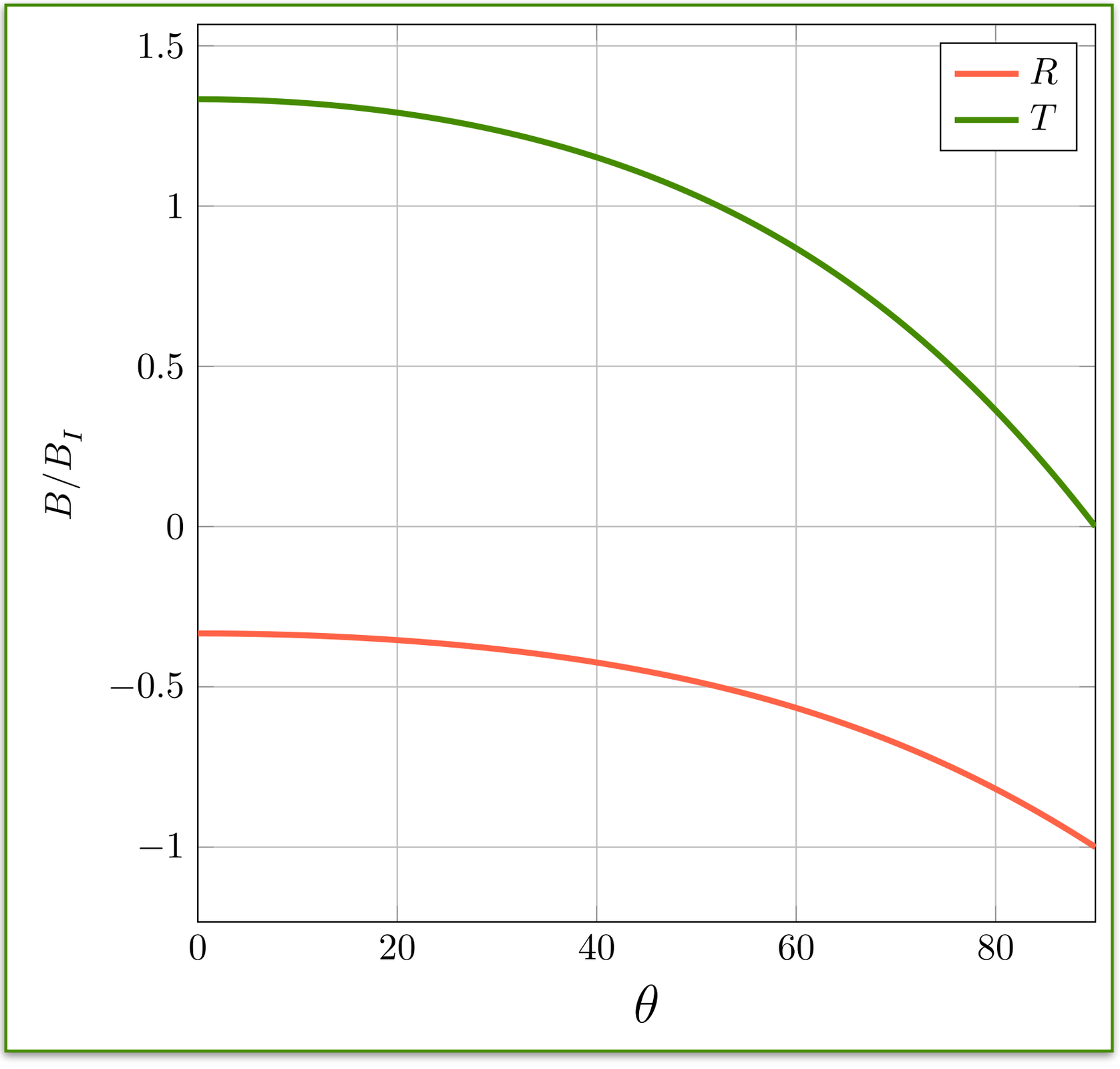


Equações de Fresnel: $\overrightarrow{B}$ paralelo

$$B_R = \frac{1 - n\gamma}{1 + n\gamma} B_I$$

$$B_T = \frac{2n}{1 + n\gamma} B_I$$

$$\gamma = \frac{\cos\theta_T}{\cos\theta}$$

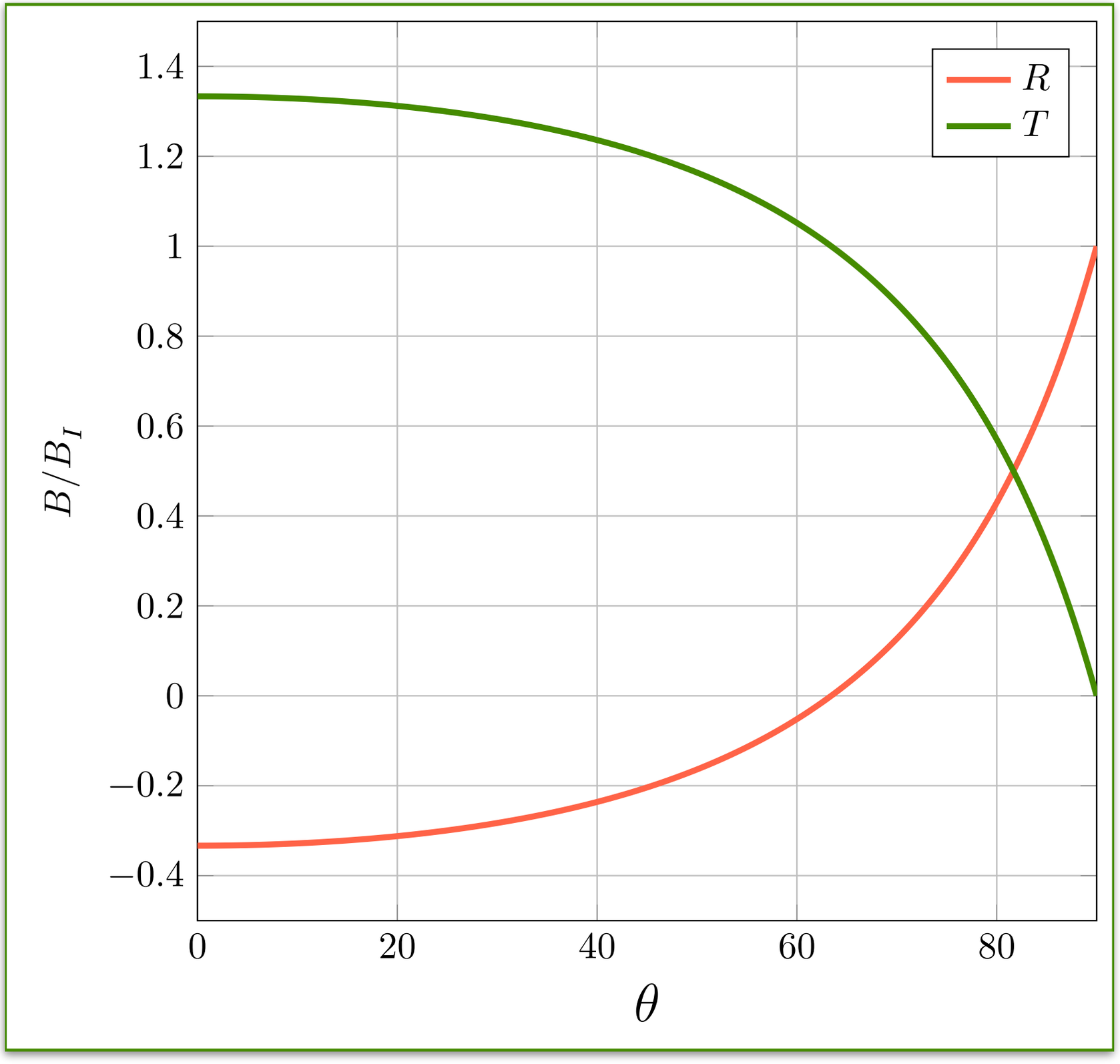


Equações de Fresnel: $\overrightarrow{B}$ perpendicular

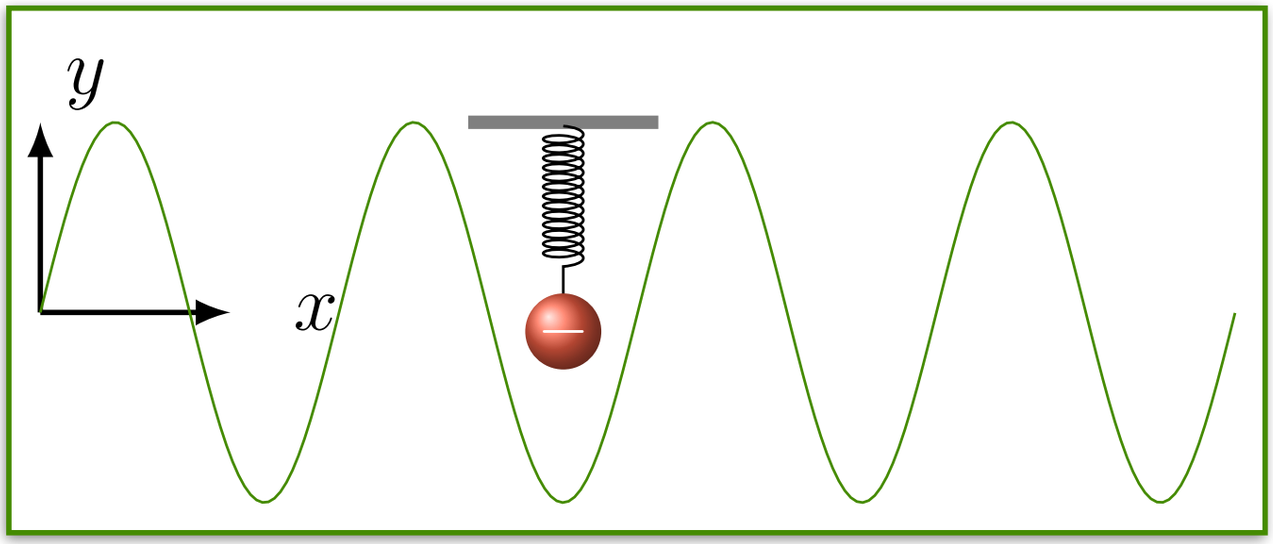
$$B_R = \frac{\gamma - n}{\gamma + n} B_I$$

$$B_T = \frac{2n}{\gamma + n} B_I$$

$$\gamma = \frac{\cos\theta_T}{\cos\theta}$$

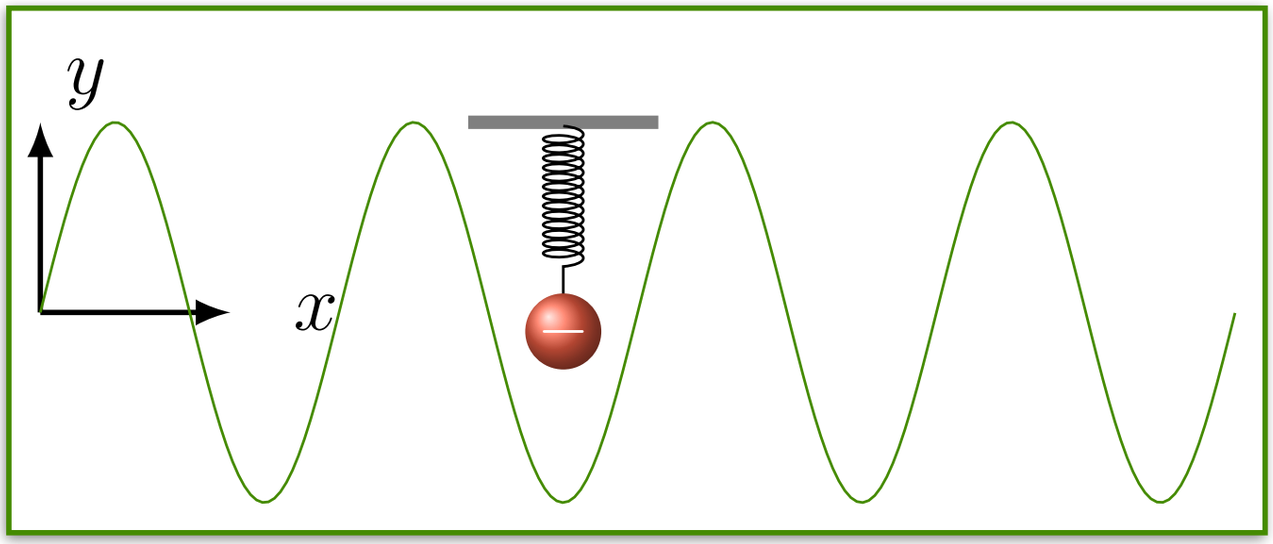


Variação de ϵ com a frequência



$$m\frac{\mathrm{d}^2y}{\mathrm{d}t^2} + m\gamma\frac{\mathrm{d}y}{\mathrm{d}t} + m\omega_0^2 y = qE_0e^{-i\omega t}$$

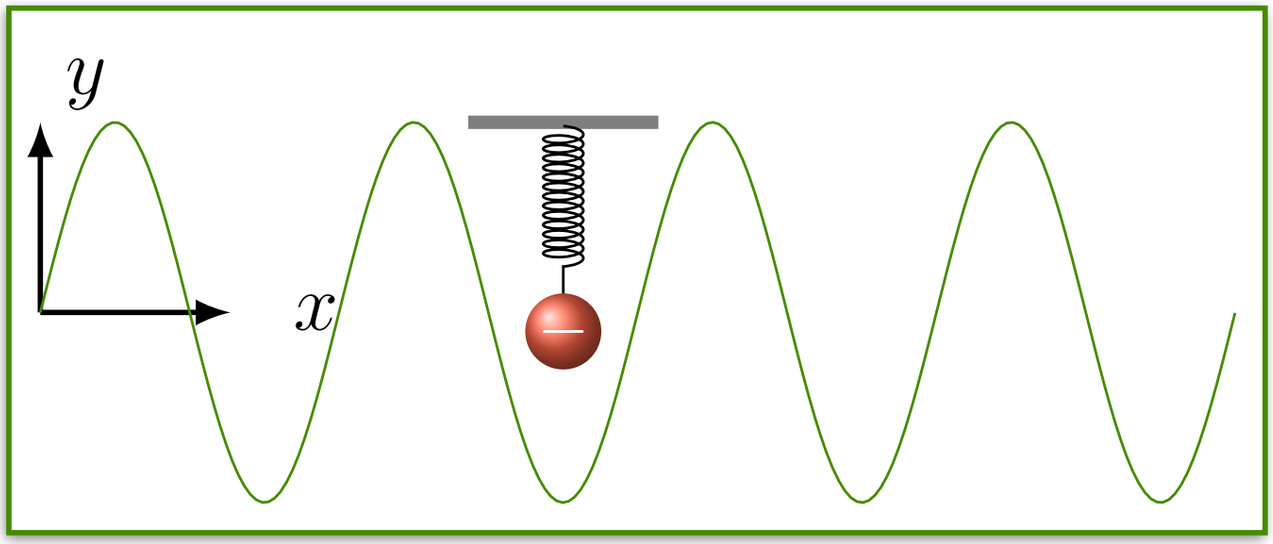
Variação de ϵ com a frequência



$$m\frac{\mathrm{d}^2y}{\mathrm{d}t^2} + m\gamma\frac{\mathrm{d}y}{\mathrm{d}t} + m\omega_0^2 y = qE_0e^{-i\omega t}$$

$$y(t) = y_0e^{-i\omega t}$$

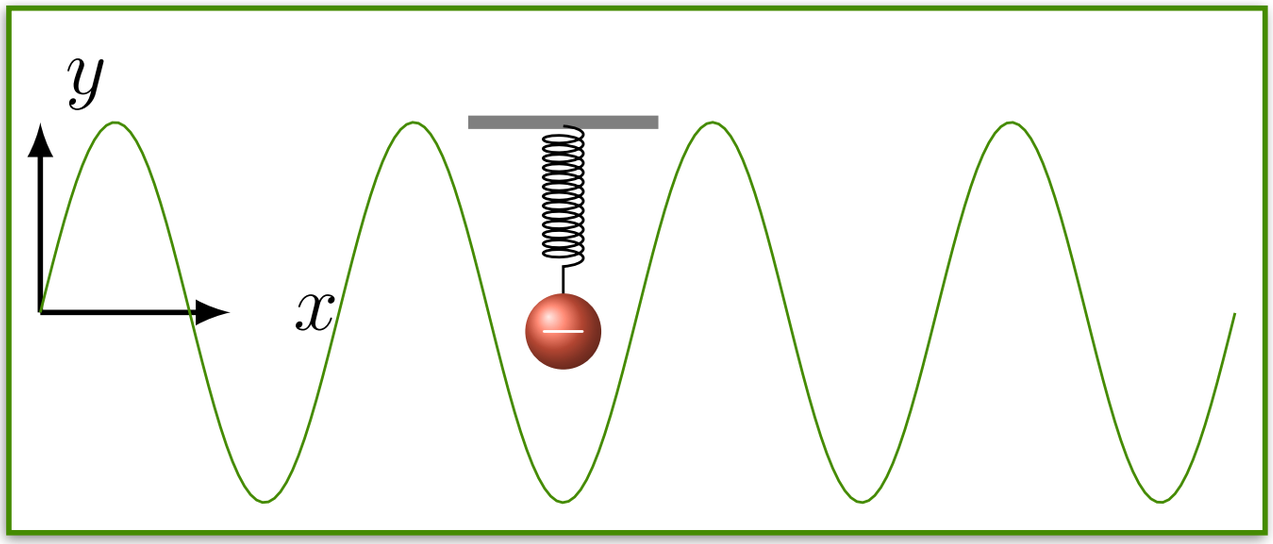
Variação de ϵ com a frequência



$$m\frac{\mathrm{d}^2y}{\mathrm{d}t^2} + m\gamma\frac{\mathrm{d}y}{\mathrm{d}t} + m\omega_0^2 y = qE_0 e^{-i\omega t}$$

$$y(t) = y_0 e^{-i\omega t} \Rightarrow \quad y_0 = \frac{qE_0}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}$$

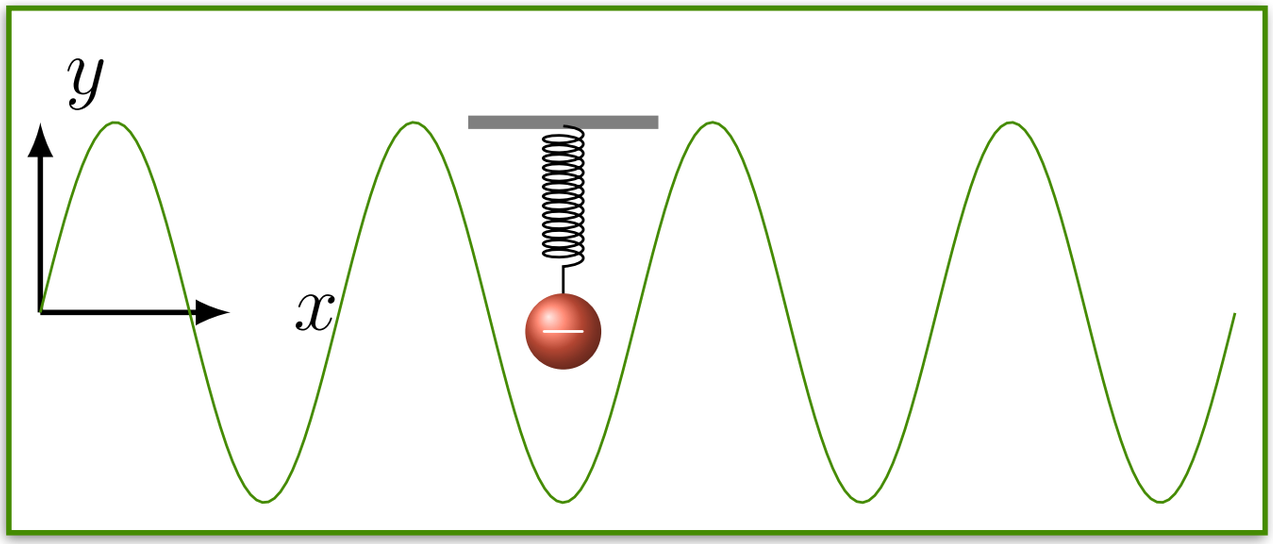
Variação de ϵ com a frequência



$$m\frac{\mathrm{d}^2y}{\mathrm{d}t^2} + m\gamma\frac{\mathrm{d}y}{\mathrm{d}t} + m\omega_0^2 y = qE_0 e^{-i\omega t}$$

$$y(t) = y_0 e^{-i\omega t} \Rightarrow \quad y_0 = \frac{qE_0}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}$$

Variação de ϵ com a frequência

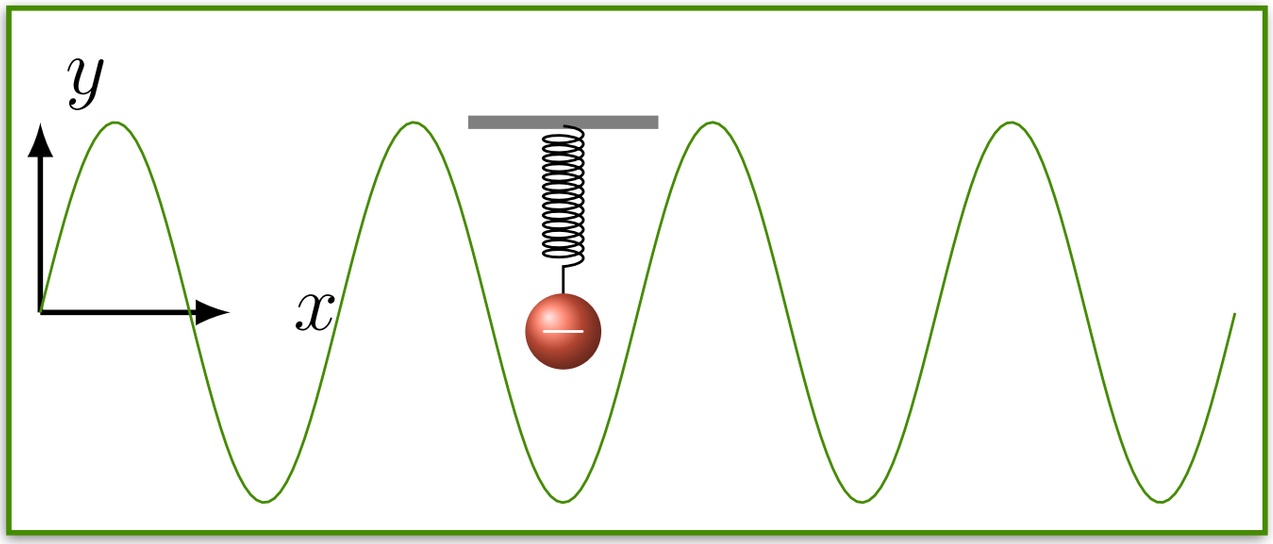


$$m\frac{\mathrm{d}^2y}{\mathrm{d}t^2} + m\gamma\frac{\mathrm{d}y}{\mathrm{d}t} + m\omega_0^2 y = qE_0e^{-i\omega t}$$

$$y(t) = y_0e^{-i\omega t} \Rightarrow \quad y_0 = \frac{qE_0}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}$$

$$\vec{\mathbf{P}} = \frac{Nq^2}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}\vec{\mathbf{E}}_0$$

Variação de ϵ com a frequência

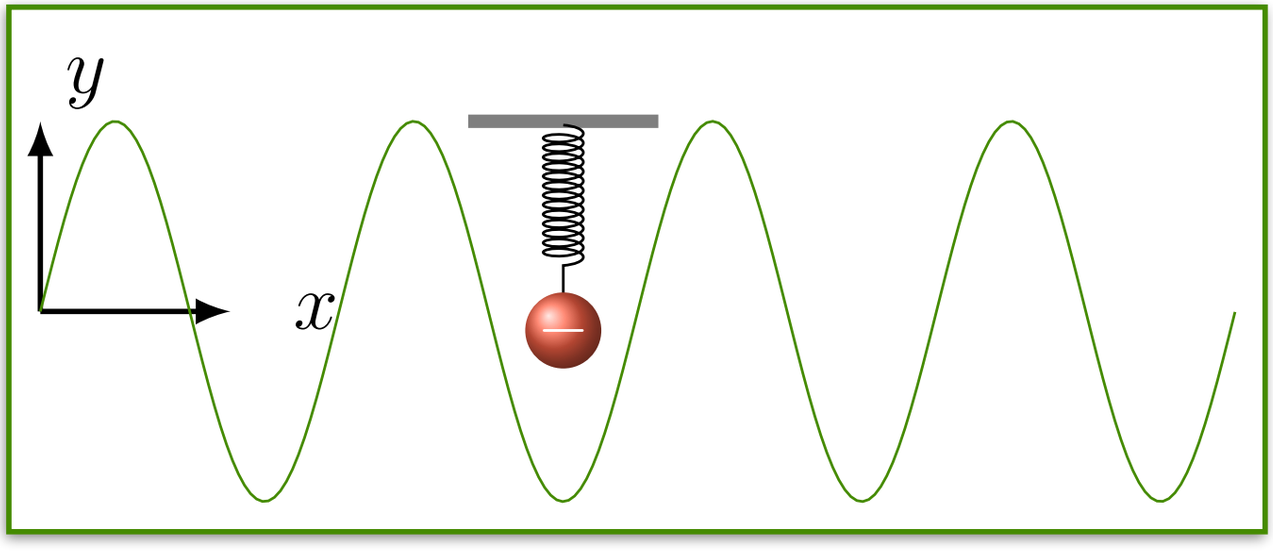


$$m\frac{\mathrm{d}^2y}{\mathrm{d}t^2} + m\gamma\frac{\mathrm{d}y}{\mathrm{d}t} + m\omega_0^2 y = qE_0e^{-i\omega t}$$

$$y(t) = y_0e^{-i\omega t} \Rightarrow \quad y_0 = \frac{qE_0}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}$$

$$\vec{\mathbf{P}} = \frac{Nq^2}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}\vec{\mathbf{E}}_0 \qquad \vec{\mathbf{P}} = \epsilon_0\chi_e\vec{\mathbf{E}}$$

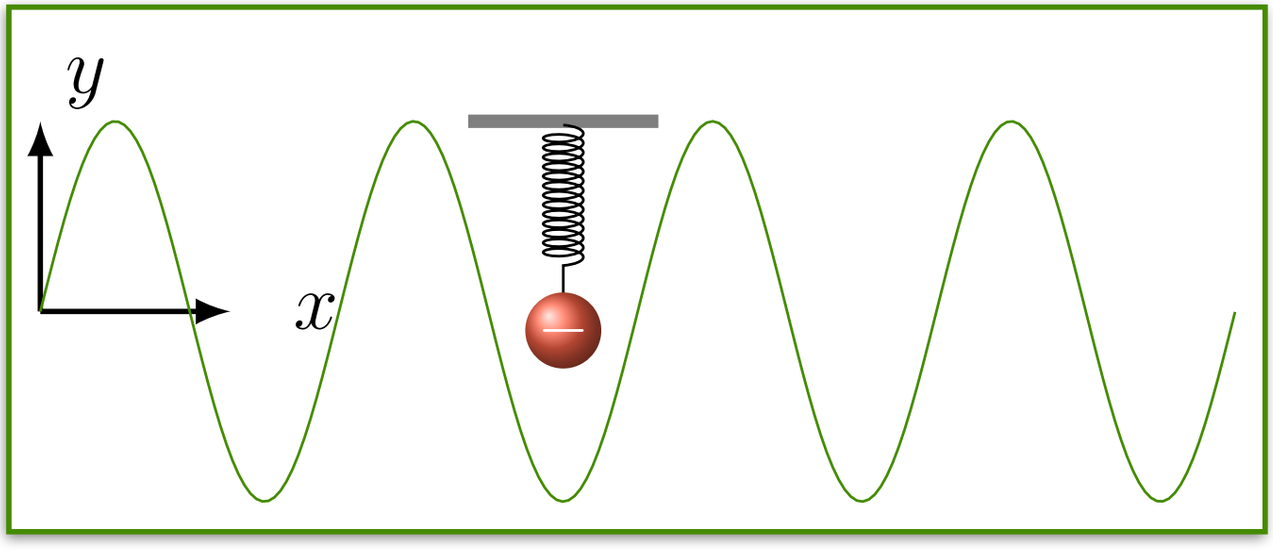
Variação de ϵ com a frequência



$$\vec{\mathbf{P}} = \frac{Nq^2}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}\vec{\mathbf{E}}_0 \qquad \vec{\mathbf{P}} = \epsilon_0\chi_e\vec{\mathbf{E}}$$

$$\epsilon = \epsilon_0\left(1 + \frac{Nq^2}{m\epsilon_0}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}\right)$$

Variação de ϵ com a frequência

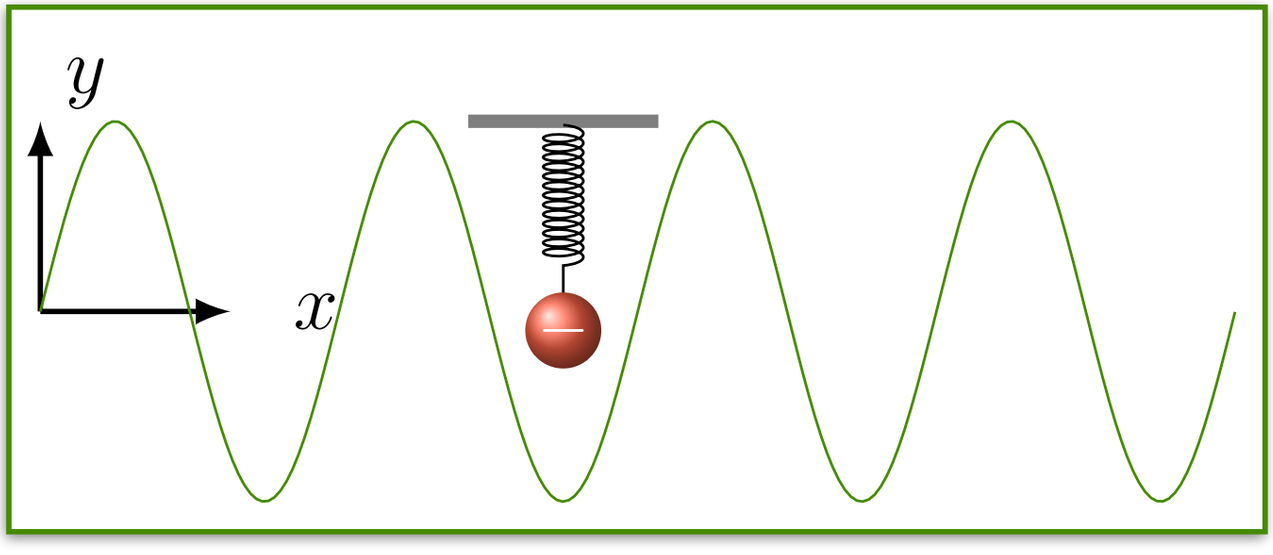


$$\vec{\mathbf{P}} = \frac{Nq^2}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}\vec{\mathbf{E}}_0 \qquad \vec{\mathbf{P}} = \epsilon_0\chi_e\vec{\mathbf{E}}$$

$$\epsilon = \epsilon_0\left(1 + \frac{Nq^2}{m\epsilon_0}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}\right)$$

$$n = \sqrt{\frac{\epsilon}{\epsilon_0}}$$

Variação de ϵ com a frequência

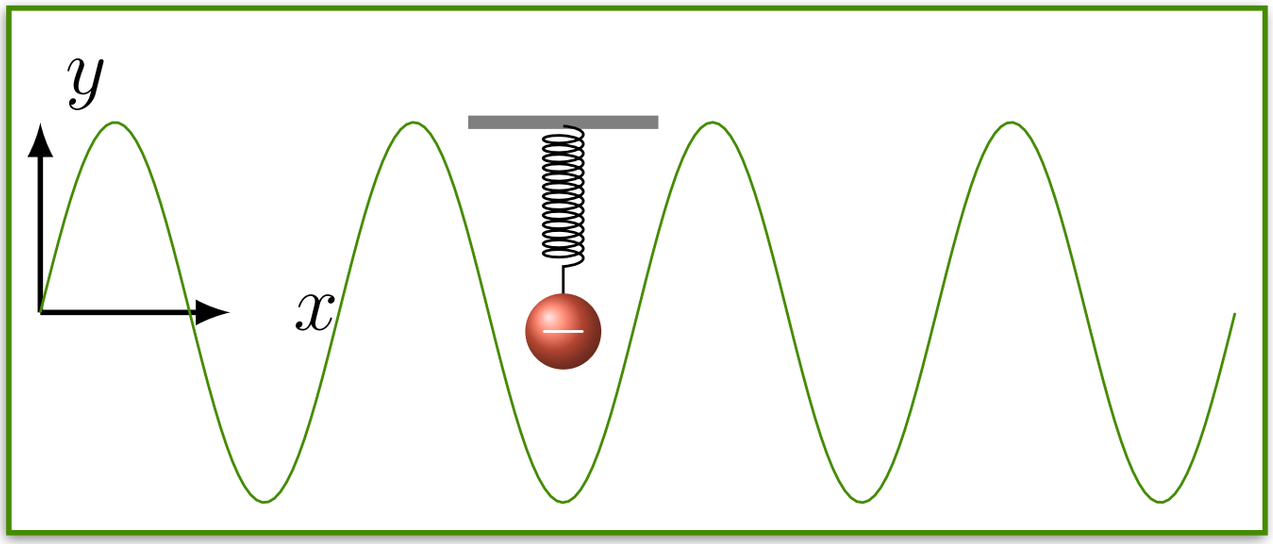


$$\vec{\mathbf{P}} = \frac{Nq^2}{m}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}\vec{\mathbf{E}}_0 \qquad \vec{\mathbf{P}} = \epsilon_0\chi_e\vec{\mathbf{E}}$$

$$\epsilon = \epsilon_0\left(1 + \frac{Nq^2}{m\epsilon_0}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega}\right)$$

$$n \approx 1 + \frac{Nq^2}{2m\epsilon_0}\frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega} \quad \Rightarrow \quad n = n_R + in_I$$

Variação de ϵ com a frequência



$$n \approx 1 + \frac{Nq^2}{2m\epsilon_0} \frac{1}{\omega_0^2 - \omega^2 - i\gamma\omega} \quad \Rightarrow \quad n = n_R + in_I$$

$$n_R + in_I = 1 + \frac{Nq^2}{2m\epsilon_0} \frac{\omega_0^2 - \omega^2}{(\omega_0^2 - \omega^2)^2 + \gamma^2\omega^2} + i\frac{Nq^2}{2m\epsilon_0} \frac{\gamma\omega}{(\omega_0^2 - \omega^2)^2 + \gamma^2\omega^2}$$

Variação de ϵ com a frequência

$$n_R + i n_I = 1 + \frac{Nq^2}{2m\epsilon_0} \frac{\omega_0^2 - \omega^2}{(\omega_0^2 - \omega^2)^2 + \gamma^2\omega^2} + i \frac{Nq^2}{2m\epsilon_0} \frac{\gamma\omega}{(\omega_0^2 - \omega^2)^2 + \gamma^2\omega^2}$$