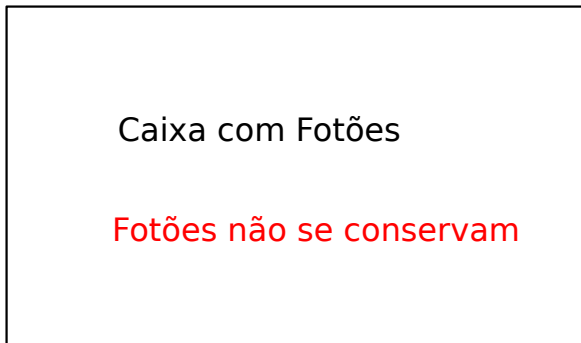


Problema 28

Sistema isolado termicamente



E_0 = energia total

E_D = energia do Demon

E = Energia do sistema

$E + E_D = E_0$ conserva-se

Energia de 1 fóton

$$E_k = \hbar c k$$

$$E_k = \hbar c n / (2L)$$

unidade de energia

$$u_E = \hbar c / (2L)$$

Energia de 1 fóton

$$E^* = E / u_E = n$$

em unidades adimensionais

$$k_x = \pi/L, 2\pi/L, 3\pi/L, \dots, \text{inf} = \pi/L \quad n_x$$

$$k_y = \pi/L, 2\pi/L, 3\pi/L, \dots, \text{inf} = \pi/L \quad n_y$$

$$k = (\pi/L) \sqrt{n_x^2 + n_y^2} = \pi n / L$$

$N_f(k)$ = numero de fótons com vetor de onda \vec{k}

Estado microscopico = $(N_f(k_1), N_f(k_2), N_f(k_3), \dots)$ onde k_1, k_2, k_3, \dots representam todos os valores possíveis de k

Energia de 1 fóton

$$E = \hbar c \sqrt{m_x^2 + m_y^2} \frac{\pi}{L}$$

$$E_0 = \frac{\hbar c \pi}{L} (m_0^2 + 1)$$

$$\hbar = h / 2\pi$$

$$m_y = 1; \quad m_x, m_0 \approx n_0$$

$$\vec{k} = \pi/L (m_x, m_y)$$

$$u_E = \frac{\hbar c}{2L}$$

$$E_k^* = \frac{E \vec{k}}{u_E} = \sqrt{m_x^2 + m_y^2} = n$$

$$E_0^2 = \left(\frac{h c T_1}{L} \right)^2 (1 + m_0^2)$$

$$1 + m_0^2 = E_0^2 \left(\frac{L}{h c T_1} \right)^2$$

$$m_0^2 = E_0^2 \frac{L^2}{(h c T_1)^2} - 1$$

$$m_0 = \sqrt{\frac{E_0^2 L^2}{(h c)^2} - 1}$$

$$m_0 = \sqrt{\left(\frac{E_0 L}{h c T_1} \right)^2 - 1}$$

$$h = \frac{h}{2\pi}$$

$$m_0 = \sqrt{\left(\frac{E_0 L}{h c} \right)^2 - 1}$$

$$m_0 = \sqrt{E_0^2 - 1}$$

$$E_0^* = \frac{E_0}{u_E}$$

$$u_E = \frac{h c}{2 L}$$