

TAF 10

$$V(x) = \frac{1}{2} m \omega^2 x^2$$

$$E_n = (n + \frac{1}{2}) \hbar \omega$$

ours?

$$\Psi(x,t) = \frac{1}{\sqrt{2}} \left[\phi_0(x) e^{-\frac{i E_0 t}{\hbar}} + \phi_1(x) e^{-\frac{i E_1 t}{\hbar}} \right]$$

car $E_0 = \frac{\hbar \omega}{2}$ et $E_1 = \frac{3\hbar \omega}{2}$

donc $\Psi(x,t) = \frac{1}{\sqrt{2}} \left[\phi_0(x) e^{-\frac{i \omega t}{2}} + \phi_1(x) e^{-\frac{3i \omega t}{2}} \right]$

on a $P(x)$ est normée.

$$\int_{-\infty}^{\infty} \Psi(x,t) \Psi^*(x,t) dx = \int_{-\infty}^{\infty} \frac{1}{2} \left[\phi_0(x) e^{-\frac{i \omega t}{2}} + \phi_1(x) e^{-\frac{3i \omega t}{2}} \right] \left[\phi_0^*(x) e^{\frac{i \omega t}{2}} + \phi_1^*(x) e^{\frac{3i \omega t}{2}} \right] dx$$

$$= \int_{-\infty}^{\infty} \frac{1}{2} \left[\phi_0^2(x) + \phi_0 \phi_1 e^{i \omega t} + \phi_0 \phi_1 e^{-i \omega t} + \phi_1^2(x) \right] dx$$

$$= \int_{-\infty}^{\infty} \frac{1}{2} \left[\phi_0^2(x) + \phi_1^2(x) + \phi_0 \phi_1 (e^{i \omega t} + e^{-i \omega t}) \right] dx$$

$$= \frac{1}{2} \int_{-\infty}^{\infty} \phi_0^2(x) dx + \int_{-\infty}^{\infty} \phi_1^2(x) dx + 2 \cos(\omega t) \int_{-\infty}^{\infty} \phi_0(x) \phi_1(x) dx$$

$\underbrace{\int_{-\infty}^{\infty} \phi_0^2(x) dx}_{=1 \text{ et Normée}} + \underbrace{\int_{-\infty}^{\infty} \phi_1^2(x) dx}_{=1 \text{ et Normée}} + 2 \cos(\omega t) \underbrace{\int_{-\infty}^{\infty} \phi_0(x) \phi_1(x) dx}_{=0 \text{ car } \phi_0, \phi_1 \text{ orthogonales}}$

$$= \frac{1}{2} \times 2 = 1 \quad \underline{\text{CQFD}}$$

$$2) \langle x \rangle = \int_{-\infty}^{+\infty} x \psi^*(x,t) \psi(x,t) dx$$

$$= \int_{-\infty}^{+\infty} \frac{1}{2} x [\phi_0^2(x) + \phi_1^2(x) + 2 \cos(\omega t) \phi_0(x) \phi_1(x) dx]$$

$$= \frac{1}{2} \int_{-\infty}^{+\infty} x \phi_0^2(x) dx + \int_{-\infty}^{+\infty} x \phi_1^2(x) dx + 2 \cos(\omega t) \int_{-\infty}^{+\infty} x \phi_0(x) \phi_1(x) dx$$

$\begin{matrix} = 0 & & = 0 \\ \text{symétrie} & & \text{symétrie} \end{matrix}$

$$= \cos(\omega t) \underbrace{\int_{-\infty}^{+\infty} x \phi_1(x) \phi_2(x) dx}_A$$

$$\langle x \rangle = A \cos(\omega t)$$

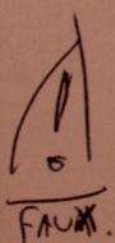
~~travaux~~

$$E_0 = \frac{\hbar \omega}{2} \Rightarrow \omega = \frac{2E_0}{\hbar}$$

$$E_1 = \frac{3\hbar \omega}{2} \Rightarrow \omega = \frac{2E_1}{3\hbar}$$

signification physique: ?

$$3) \lambda = 5330 \text{ nm}$$



~~travaux~~

$$k = \frac{2\pi}{\lambda}$$

$$\Rightarrow k = \frac{2\pi}{5330 \times 10^{-9}} = 1,17 \times 10^6 \text{ N.m}^{-1}$$