1 Perturbation dépendante du temps

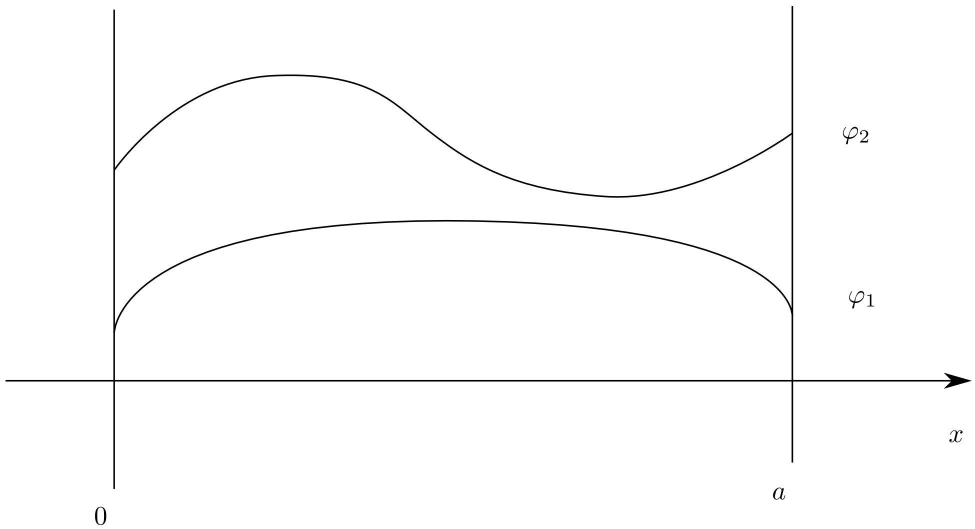

FIGURE 1 – Puit de potentiel 2 2

$$\varphi_n(x) = \sqrt{\frac{2}{a}} \sin \frac{\pi n x}{a} \quad (n \geq 1)$$

$$W(t) = \begin{cases} 0 & t < 0 \\ qE_0 x e^{-t/\tau} & t \geq 0 \end{cases}$$

$$\mathcal{P}_{1\to 2}(t \to \infty) = ?$$

$$\mathcal{P}_{1\to 2}(t) = \frac{1}{\hbar^2} \left| \int_0^t \langle \varphi_2 | \, W(s) \, | \varphi_1 \rangle \, e^{i(E_{2-E_1})s/\hbar} \mathrm{d}s \right|^2$$

$$= 1\frac{1}{2} \left| \int_0^t e^{-(\frac{1}{\tau} - i\omega_{12})s} \mathrm{d}s \right|^2 \| \langle \varphi_2 | \, qE_0 X \, | \varphi_i \rangle \|^2$$

$$\frac{(qE_0)^2}{\hbar^2} \frac{1}{\omega_{12}^2 + \frac{1}{\tau^2}} \left| \int_0^a x \frac{2}{a} \sin\left(\frac{2\pi x}{a} \sin\left(\frac{\pi x}{a} \right) \mathrm{d}x \right) \right|^2$$

$$\cos(a \pm b) = \cos a \cos b \mp \sin a \sin b$$

$$\cos(a - b) = \cos(a + b) = 2 \sin a \sin b$$

$$\int_u x \cos(ax)\mathrm{d}x = [\cos(ax)] - \int \cos(ax)\mathrm{d}x$$

$$= \frac{256}{81\pi^4} \left(\frac{qE_0 a^2}{\hbar} \right)^2 \frac{1}{\omega_{12}^2 + \frac{1}{\tau^2}}$$

On suppose une perturbation stationnaire $W = qE_0 X$

$$\left| \varphi_1^{(1)} \right\rangle = |\varphi_1\rangle - \sum_{p \neq 1} \frac{\langle \varphi_p | W | \varphi_i \rangle}{E_i - E_f} |\varphi_p\rangle$$

$$\mathcal{P}_{1 \to 2} = \left\| \langle \varphi_2 | \varphi_1^1 \rangle \right\|^2 = \left| \frac{\langle \varphi_2 | W | \varphi_1 \rangle}{E_1 - E_2} \right|^2 = \frac{(qE_0)^2}{\hbar^2}$$