(6)

(f) La densidad de probabilidad
Así:

$$\mathcal{P}(p) = \| \, |p\rangle\langle p|\psi(t)\rangle \|^2$$

$$= |\langle p|\psi(t)\rangle|^2$$

$$= |\phi(p,t)|^2$$

donde:

$$\phi(p,t) = \langle p|\psi(t)\rangle = \frac{1}{\sqrt{3}} e^{-\frac{i}{\hbar}\varepsilon_0 t} \langle p|\varphi_0\rangle + i\sqrt{\frac{2}{3}} e^{-i\frac{\varepsilon_1}{\hbar}t} \langle p|\varphi_1\rangle$$

En esta expresión:

$$\langle p|\varphi_n\rangle = \int_{-\infty}^{+\infty} dx \, \langle p|x\rangle\langle x|\varphi_n\rangle = \int_{-\infty}^{+\infty} dx \, e^{-i\frac{px}{\hbar}} \varphi_n(x)$$

es la transf. de Fourier de $\varphi_n(x)$. Esto corresponde a:

$$\bar{\varphi}_n(p) \equiv \langle p|\varphi_n\rangle = (-1)^n \frac{1}{\beta\sqrt{\hbar}} \varphi_n\left(x = \frac{p}{\hbar\beta^2}\right)$$

Luego

$$\phi(p,t) = \frac{1}{\sqrt{\hbar}\,\beta}\left( \frac{1}{\sqrt{3}} e^{-\frac{i}{\hbar}\varepsilon_0 t} \varphi_0\left(\frac{p}{\hbar\beta^2}\right) - i\sqrt{\frac{2}{3}} e^{-\frac{i}{\hbar}\varepsilon_1 t} \varphi_1\left(\frac{p}{\hbar\beta^2}\right)\right)$$