

Probability of finding the particle:

Knowing that $\int_{-\infty}^{\infty} \psi_n \cdot \psi_m^* = 0$ if ψ_n, ψ_m^* they are lineally independent (l.i.) $n \neq m$

$\int_{-\infty}^{\infty} \psi_n \cdot \psi_m^* = 1$ if ψ_n, ψ_m^* they are lineally dependent (l.d.)
 $n = m$

$$\psi_n = N_A \cdot \phi_A + i N_B \cdot \phi_B$$

$$\psi_n^* = N_A \cdot \phi_A - i \cdot N_B \cdot \phi_B$$

$$\begin{aligned} \psi_n \cdot \psi_n^* &= N_A^2 \cdot \phi_A^2 - i \cdot N_A \cdot \phi_A N_B \cdot \phi_B + i N_A \cdot \phi_A N_B \cdot \phi_B + N_B^2 \cdot \phi_B^2 = \\ &= N_A^2 \cdot \phi_A^2 + N_B^2 \cdot \phi_B^2 \end{aligned}$$

$$\int \psi_n \cdot \psi_n^* \cdot dx = \int N_A^2 \cdot \phi_A^2 + \int N_B^2 \cdot \phi_B^2 = N_A^2 + N_B^2 = 1$$

$$\frac{d\rho}{dt} = -\Delta \vec{J} \quad \text{and} \quad \frac{dN(t)}{dt} = 0 = \int dx \cdot \frac{d\rho}{dt}$$

Normalization does not vary over time

Where ρ represents the probability of finding the particle versus time .

$$\frac{d\rho}{dt} = \frac{i\hbar}{2m} \cdot \frac{\partial}{\partial x} \left(\frac{\partial \psi^*}{\partial x} \psi - \psi^* \frac{\partial \psi}{\partial x} \right)$$

$$\begin{aligned} \Delta(\vec{J}) &= \nabla(\psi \nabla \psi^* - \nabla \psi \psi^*) \\ &= \nabla \psi \nabla \psi^* + \psi \nabla^2 \psi^* - \nabla^2 \psi \psi^* - \nabla \psi \nabla \psi^* \end{aligned}$$

$$\Delta(\vec{J}) = \frac{i\hbar}{2m} \left(\frac{\partial^2 \psi^*}{\partial x^2} \psi - \psi^* \frac{\partial^2 \psi}{\partial x^2} \right)$$