

$$\langle x | \psi \rangle = \langle x | \sum_{i=1}^N c_i |\phi_i \rangle \rightarrow \psi(x) \sim \text{fungsi gelombang}$$

ket / keadaan kuantum

basis

kompleks

$$|\psi(x)|^2 = \psi^*(x) \psi(x)$$

\downarrow rapat probabilitas

$\int_{a=-\infty}^{b=\infty} |\psi(x)|^2 dx = 1$

probabilitas menemukan partikel pada x

$x \rightarrow x + dx$

$$|\Psi\rangle = c_1 |\phi_1\rangle + c_2 |\phi_2\rangle + \dots + c_N |\phi_N\rangle$$

Himpunan: $\{|\phi_i\rangle\}$ orthonormal
basis

$$|\Psi\rangle_{\text{spin}} = c_{\uparrow} | \uparrow \rangle + c_{\downarrow} | \downarrow \rangle \langle \phi_i | \phi_j \rangle = \begin{cases} 1, & i=j \\ 0, & i \neq j \end{cases}$$

$\frac{1}{\sqrt{2}}$

$$\begin{matrix} i \cdot i \\ i \cdot j \end{matrix} = 1 \\ i \cdot j = 0$$

$$\sum_{i=1}^n |c_i|^2 = 1$$

$$|c_i|^2 = \Pr(|\phi_i\rangle)$$

photon $|\Psi\rangle_{\text{photon}}$
electron $|\Psi\rangle_{\text{electron}}$

$$|\Psi\rangle = \left(\frac{1}{\sqrt{2}} |H\rangle + \frac{1}{\sqrt{2}} |V\rangle \right)_{\text{photon}} \otimes \left(\begin{matrix} 1 & 0 \\ 0 & -1 \end{matrix} \right)_{\text{electron}}$$

SG: $+\frac{1}{2} S_x$, $-\frac{1}{2} S_z$

Photon @ SG:

- (1) $|H\rangle$
- (2) $|H\rangle$
- (3) $|V\rangle$

Electron @ SG:

- (1) $|H\rangle$
- (2) $|V\rangle$

$$\begin{matrix} 499 \\ 501 \end{matrix} \xrightarrow{\text{+1}} |H\rangle$$

$$\xrightarrow{-1} |V\rangle$$

$$|\Psi\rangle = \sum c_i |\phi_i\rangle$$

$$x = \bar{x} \pm \sigma \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

$$\hat{O}|\Psi\rangle = \lambda |\Psi\rangle$$

besaran (observabel)
fisis
yg
mudah
diukur

$$\{\lambda_i\}$$

$$\begin{array}{ccc} \lambda_1 & \rightarrow & |\psi_1\rangle \\ \lambda_2 & \rightarrow & |\psi_2\rangle \\ \vdots & \downarrow & \vdots \\ \lambda_n & \rightarrow & |\psi_n\rangle \end{array}$$

$$\langle \hat{O} \rangle = \sum_i \Pr(\lambda_i) \cdot \lambda_i$$

$$= \sum_i |c_i|^2 \cdot \lambda_i$$

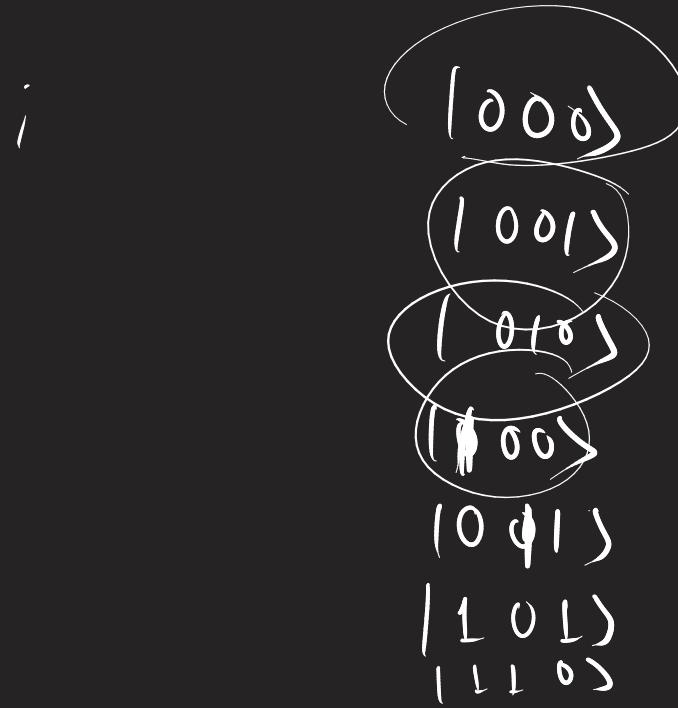
$$= \frac{1}{2} \cdot (+1) + \frac{1}{2} (-1)$$

$$= 0$$

$$\Delta \hat{O} = \sqrt{\langle \hat{O}^2 \rangle - \langle \hat{O} \rangle^2}$$

$$|\psi_0\rangle = \underbrace{|0\rangle \otimes |0\rangle \otimes |0\rangle}_{\text{dots}} = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \otimes \begin{bmatrix} 1 \\ 0 \end{bmatrix} \otimes \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$|\psi_1\rangle$



$$|\psi_2\rangle = |111\rangle = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$