OPTI 570 RECAP Th Sep 11

- derivation of unc rel.

$\langle x | [\hat{x}, \hat{p}] | \psi \rangle =$

$\hat{p} \to -i\hbar \frac{\partial}{\partial x}$

$\hat{x} \to \cdot x$

$= \langle x | \hat{x}\hat{p} - \hat{p}\hat{x} | \psi \rangle =$

$= \langle x | \hat{x} \left(-i\hbar \frac{\partial}{\partial x} | \psi \rangle - \langle x | \hat{p} | \left(x \cdot | \psi \rangle\right) =$

$= \langle x | x \cdot -i\hbar \frac{\partial}{\partial x} | \psi \rangle - \langle x | -i\hbar \frac{\partial}{\partial x} \left(x \cdot | \psi \rangle\right) =$

$= x \cdot \left(-i\hbar \frac{\partial}{\partial x}\right) \langle x | \psi \rangle + i\hbar \cdot \left(\frac{\partial}{\partial x} \langle x | \psi \rangle + \langle x | \psi \rangle\right) =$

$= \cancel{-i\hbar x \frac{\partial \psi}{\partial x}} \cancel{+ i\hbar x \frac{\partial \psi}{\partial x}} + i\hbar \psi(x) =$

.....

- discrete basis representations

$\left(\langle \psi | u_1 \rangle , \langle \psi | u_2 \rangle \ldots \right)$

$\begin{pmatrix} \langle u_1 | \psi \rangle \\ \langle u_2 | \psi \rangle \\ \vdots \\ \vdots \end{pmatrix}$

$\langle \psi | A | \psi \rangle$

$\hat{A}_{\{u_m\}} = \Bigg(\quad$

Postulate V $\quad \hat{A}|u_n\rangle = a_n|u_n\rangle$

$$|\psi\rangle \xrightarrow{\text{measure}} \underbrace{\boxed{|u_n\rangle\langle u_n|}}_{\text{projector } \hat{P}_{|u_n\rangle}}\psi\rangle$$

$$\frac{\hat{P}_n|\psi\rangle}{\sqrt{\langle\psi|\hat{P}_n|\psi\rangle}}$$

$$\hat{A}|u_n\rangle = a_n|u_n\rangle$$

$$\hat{A}|\psi\rangle = c\cdot|\varphi\rangle$$

$$\left[\begin{array}{l} \hat{x}|\psi\rangle = b|\varphi\rangle \\ \varphi(x) = \frac{x}{b}\psi(x) \end{array}\right]$$

$$\varphi(x) = \langle x|\varphi\rangle$$

$$\psi(x) = \langle x|\psi\rangle$$

$$\frac{x}{\cancel{b}}\langle x|\psi\rangle = \frac{1}{\cancel{b}}\langle x|\hat{x}|\psi\rangle$$

$$x\langle x|\psi\rangle = \langle x|\hat{x}|\psi\rangle \qquad |:|\psi\rangle$$

$$x\langle x| = \langle x|\hat{x} \qquad |\ \text{HC.}$$

$$|x\rangle x^* = \hat{x}^\dagger|x\rangle$$

x - Hermitian

$$\boxed{\hat{x}|x\rangle = x|x\rangle}$$

$$\mathbb{1} = \sum_n |u_n\rangle\langle u_n|$$

$$\mathbb{1} = \int_{-\infty}^{\infty} \varphi_n^*(x)\,\varphi_n(x)\,dx$$