OPTI 570 Recap 2

Fourier
$$\psi(x) = \langle x|\psi\rangle$$
$$\bar{\psi}(p) = \langle p|\psi\rangle$$

$$\delta(x - x_0) \neq |x_0\rangle$$

$$\delta(x - x_0) = \langle x|x_0\rangle$$

$$\langle x|\underline{x\rangle} = 1$$

x_0 $|\ldots\rangle \in \mathcal{E}$

$$|\psi\rangle = \begin{pmatrix} \vdots \\ \vdots \end{pmatrix} \qquad \langle\psi| = (\ \ldots\ldots\ )$$

$$\hat{A} = \begin{pmatrix} \ddots & \text{sq. matrix} \\ & \end{pmatrix}$$

- basis

$$\underline{\psi(x) = \langle x|\psi\rangle}$$
$$\bar{\psi}(p) = \langle p|\psi\rangle$$

- <u>bases</u> - <u>orthonormal.</u> - orthogonal
  - normalizable.

Hilbert space $\mathcal{E} \neq$ Function space $\mathcal{F}$

$$\underline{|\psi\rangle} \neq \underline{\psi(x)}$$
$$\langle x|\psi\rangle = \psi(x)$$

$\mathcal{E}$ $\mathcal{E}$

Operators: $\hat{A}\,|\varphi\rangle = c\,|\varphi'\rangle$

$\hat{A}\,|c_1\varphi_1 + c_2\varphi_2\rangle = c_1 \cdot \hat{A}|\varphi_1\rangle + c_2\hat{A}|\varphi_2\rangle$

$= c_1\, c \cdot |\varphi_1'\rangle + c_2\, c\, |\varphi_2'\rangle$

- Linearity

$\hat{A}(\hat{B}\,|\varphi\rangle) \neq \hat{B}(\hat{A}|\varphi\rangle)$ in general.

commutator: $[\hat{A},\hat{B}] = \hat{A}\hat{B} - \hat{B}\hat{A} \neq 0$ in general.

$[\hat{A},\hat{B}] = 0 \Rightarrow$ " $\hat{A}$ and $\hat{B}$ commute"

$\hat{A}\,\hat{B}\,|\varphi\rangle = \hat{B}\hat{A}\,|\varphi\rangle$

$[\hat{A},\hat{B}] \neq 0 \Rightarrow$ " .... DO NOT Commute"

$|\ldots\rangle$

Closure relation:

basis $|u_n\rangle$ - discrete $n \geq 0$

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