

Quantum Mechanics foundation recap. (QM 1 in two pages)

Physical system described by its state ψ

we learn about it by making measurement described by operator

$$\hat{O} : \hat{O}|\psi\rangle = \sum O_n |O_n\rangle$$

projection i.e. measured value of operator \hat{O} eigen state

important properties of operator and state set

1. $\langle O_n | O_m \rangle = \delta_{nm}$ ← orthonormal set

2. $\sum_n |O_n\rangle \langle O_n| = \hat{1}$ ← completeness

if there is another operator \hat{Q} , with eigen state $|q_m\rangle$ it can be decompose in super position of $|O_n\rangle$

3. $|q_m\rangle = \sum_n C_{nm} |O_n\rangle$, $C_{nm} = \langle O_n | q_m \rangle$

Evolution of the system in time
described by Schrodinger eq.

$$i\hbar \frac{d}{dt} |\psi\rangle = \hat{H} |\psi\rangle$$

\hat{H} - Hamiltonian of the system
represent its Energy

$$\hat{H} |E_n\rangle = E |E_n\rangle$$

if \hat{H} does not depend on time

$$|E_n(t)\rangle = e^{-\frac{iE_n}{\hbar}t} |E_n(0)\rangle$$

$$|\psi(0)\rangle = \sum c_n |E_n\rangle \Rightarrow |\psi(t)\rangle = \sum c_n e^{-\frac{iE_n}{\hbar}t} |E_n(0)\rangle$$

i.e. it is trivial
we still need
 $|E_n(0)\rangle$!
to make it
useful