ENGINEERING PHYSICS

Radhakrishnan S, Ph.D.

Department of Science and Humanities

- **State function - probability amplitude**

- **Probability density**

- **Normalization of wave function**

➢ *Suggested Reading*

 1. *Concepts of Modern Physics, Arthur Beiser, Chapter 5*

 2. *Learning Material prepared by the Department of Physics*

➢ *Reference Videos*

 1. *Video lectures : MIT 8.04 Quantum Physics I*

Wave function as a state function

- *The wave function satisfying all the conditions is a state function*

- $\psi = Ae^{i(kx - \omega t)}$

- $k = \dfrac{p}{\hbar}$ and $\omega = \dfrac{E}{\hbar}$

- The wave function $\psi = Ae^{\frac{i}{\hbar}(px - Et)}$

- *The wave function can provide information about the state of the system*

Probability density ....

- *The square of the probability amplitude is the probability density*

- *The product $\psi^*\psi$ is $|\psi|^2$ - a real number*

- *Which gives the probability of finding the particle in unit length of space in one dimension*

- *Or probability of finding the particle in unit volume in three dimensional space*

Normalization of wave functions

- *The integral* $\int \psi^* \psi \, dx = 1$

  should give the total probability in the range where

  the function is defined

- ψ *is a localized function* -> $\psi \to 0 \ as \ x \to \pm\infty$

- $\int_{-\infty}^{+\infty} \psi^* \psi \, dx = 1$

- *The given wave function must be normalizable*

- *The process of normalization gets the right form of* **A**

The concepts of wave functions which are correct …..

1. In 3D, $\psi^*\psi$ gives the probability density of finding the particle in unit volume

2. A normalized wave function describes the physical state of the system

3. All physical parameters of the system can not be inferred from the wave function

4. The wave functions is only a probability amplitude and has no physical significance

THANK YOU

Radhakrishnan S, Ph.D.

Professor, Department of Science and Humanities

sradhakrishnan@pes.edu

+91 80 21722683 Extn 759