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# **ENGINEERING PHYSICS**

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# ENGINEERING PHYSICS

## Unit I : Review of concepts leading to Quantum Mechanics

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- **Wave function as a state function**
- **Double slit experiment revisited**
- **Linear Superposition of wave functions**

### ➤ *Suggested Reading*

1. *Concepts of Modern Physics, Arthur Beiser, Chapter 5*
2. *Learning Material prepared by the Department of Physics*

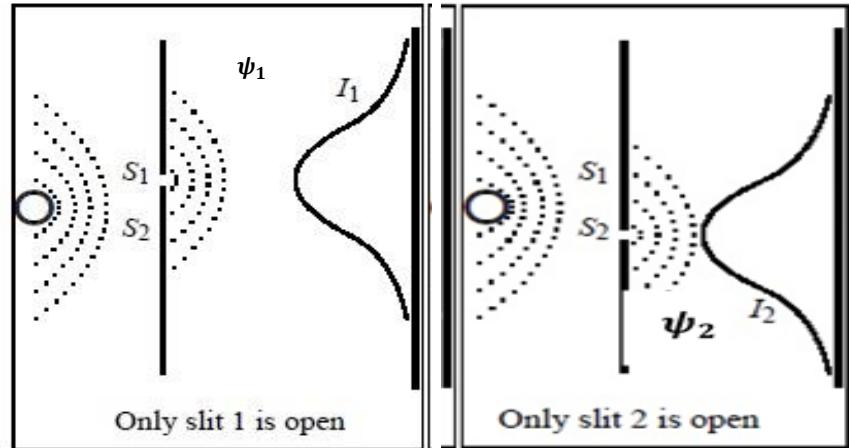
### ➤ *Reference Videos*

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

- ***The wave function satisfying all the conditions is a state function***
- $\psi = Ae^{i(kx-\omega t)}$
- $k = \frac{p}{\hbar}$  and  $\omega = \frac{E}{\hbar}$
- ***The wave function  $\psi = Ae^{\frac{i}{\hbar}(px-Et)}$  can provide information about the state of the system***

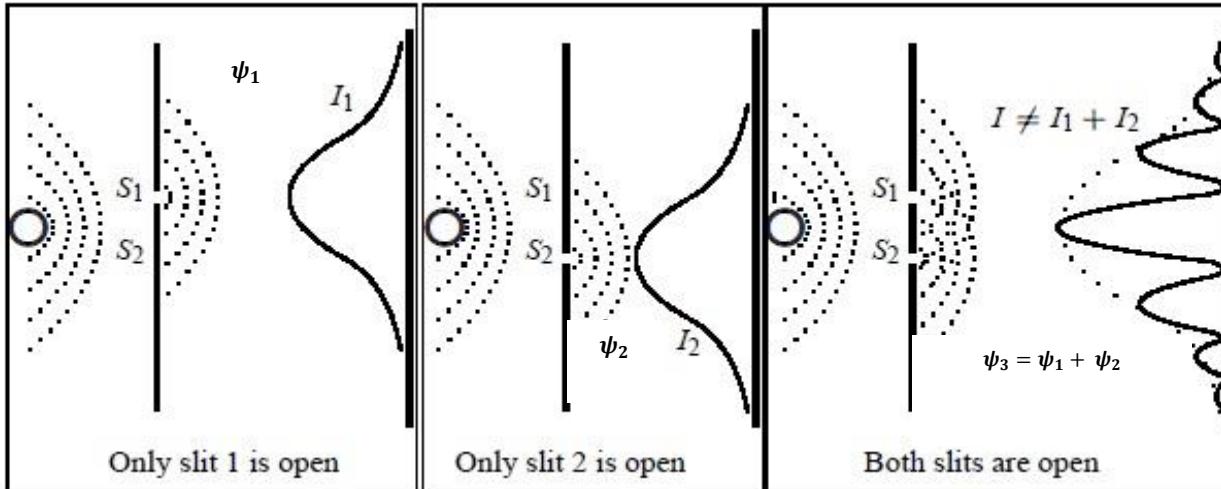
## Double slit experiment revisited

- $\psi_1$  is the wave function for photons from slit 1
- $I_1 = |\psi_1|^2$  is probability the photon reaches the screen
- $\psi_2$  is the wave function for photons from slit 2
- $I_2 = |\psi_2|^2$  is probability the photon reaches the screen



## Double slit experiment revisited

- $\psi_3 = \psi_1 + \psi_2$  is the superposed wave function for photons from both slits
- $I_3 = |\psi_3|^2$  is the combined probability of photons reaching the screen  $I_3 \neq I_1 + I_2$
- $|\psi_3|^2 = |\psi_1|^2 + |\psi_2|^2 + \psi_1^* \psi_2 + \psi_1 \psi_2^* \neq |\psi_1|^2 + |\psi_2|^2$



## Linear superposition of wave functions

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- *The number of photons emerging from the slits can be different*
- *The superposed wave function  $\psi_3 = m \cdot \psi_1 + n \cdot \psi_2$*
- *m and n are arbitrary constants*
- *This is the principle of linear superposition of wave functions*

- 1. Double slit experiment conclusively proves the wave nature of matter**
- 2. The probability distribution of a double slit experiment is the superposition of the probability density of waves from the single slit operation**
- 3. Single particles cannot be diffracted at the double slit**



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**THANK YOU**

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