

A **quantum state** is the complete description of a quantum system, containing all the information about a system's possible measurable properties. It defines how a quantum system (such as a qubit, an electron, or even an atom) behaves and evolves over time.

Key Concepts of a Quantum State:

1. **Superposition** – A quantum system can exist in multiple states at once until it is measured.
2. **Entanglement** – Two or more quantum states can be linked, meaning the state of one depends on the state of another, no matter the distance.
3. **Wavefunction (Ψ)** – A quantum state is often described using a mathematical function called the **wavefunction**, denoted as Ψ (**psi**). The wavefunction provides the probability of finding a system in a particular state when measured.
4. **Collapse Upon Measurement** – Before measurement, a system is in a superposition of states. When measured, it "collapses" into one definite state.
5. **Probability and Amplitudes** – The probability of measuring a particular state is determined by the squared magnitude of the wavefunction.

Why Is the Quantum State Important?

- It determines how a quantum system will behave when measured or manipulated.
- It enables powerful quantum computing concepts like **quantum parallelism**, allowing multiple calculations at once.
- It plays a central role in **quantum cryptography**, **teleportation**, and **quantum simulations**.