What is a Superposition State?

A **superposition state** is a fundamental concept in quantum mechanics where a qubit exists in **multiple states simultaneously** until measured. Unlike classical bits, which can only be **0 or 1**, a qubit in superposition can be **both |0⟩ and |1⟩ at the same time**, with certain probabilities.

Visualizing Superposition (Bloch Sphere Representation)

A qubit state can be represented on a **Bloch Sphere**, where:
✅ |0⟩ is at the **north pole**.
✅ |1⟩ is at the **south pole**.
✅ Superposition states lie **anywhere in between**.

🔹 **Real-World Analogy: The Spinning Coin** 🪙

Imagine a **coin spinning in the air**:

- If you **don't look**, it's in **both heads and tails** at once (**superposition**).

- The moment you **catch it and look**, it's **either heads OR tails** (**measurement** collapses it to one state).

🔹 **Key Takeaways**

✅ **Superposition** allows qubits to be in multiple states at once.
✅ **Measurement collapses** the qubit into either |0⟩ or |1⟩.
✅ **Quantum algorithms** use superposition to explore multiple solutions simultaneously.