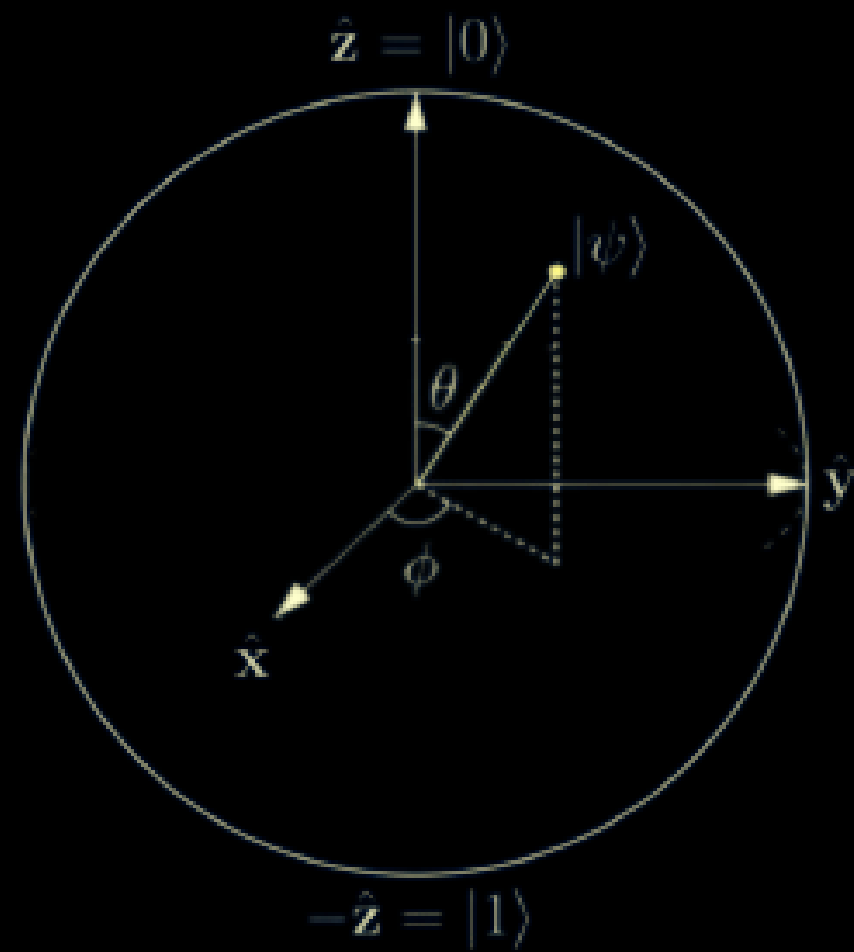AN INTRODUCTION TO

Quantum Computing

Door to a world of endless possibilities...

# What is Quantum Computing ?

Diagrammatic representation of a qubit

- Quantum Computing is a rapidly evolving field that harnesses the principles of Quantum Mechanics to process, store and manipulate information.

- Unlike Classical Computers that use bits(0s or 1s), quantum computers utilize quantum bits (**qubits**), which can exist in **superposition** and **entanglement** states. This enables these computers to perform parallel computations and tackle complex problems more efficiently.

Superposition

Superposition is a fundamental concept in quantum computing that allows a qubit to exist in multiples states simultaneously. Unlike classical bits, a qubit can be both 0 and 1 at the same time. The widely known **Schrödinger's cat** is a thought experiment that illustrates this physical paradox.
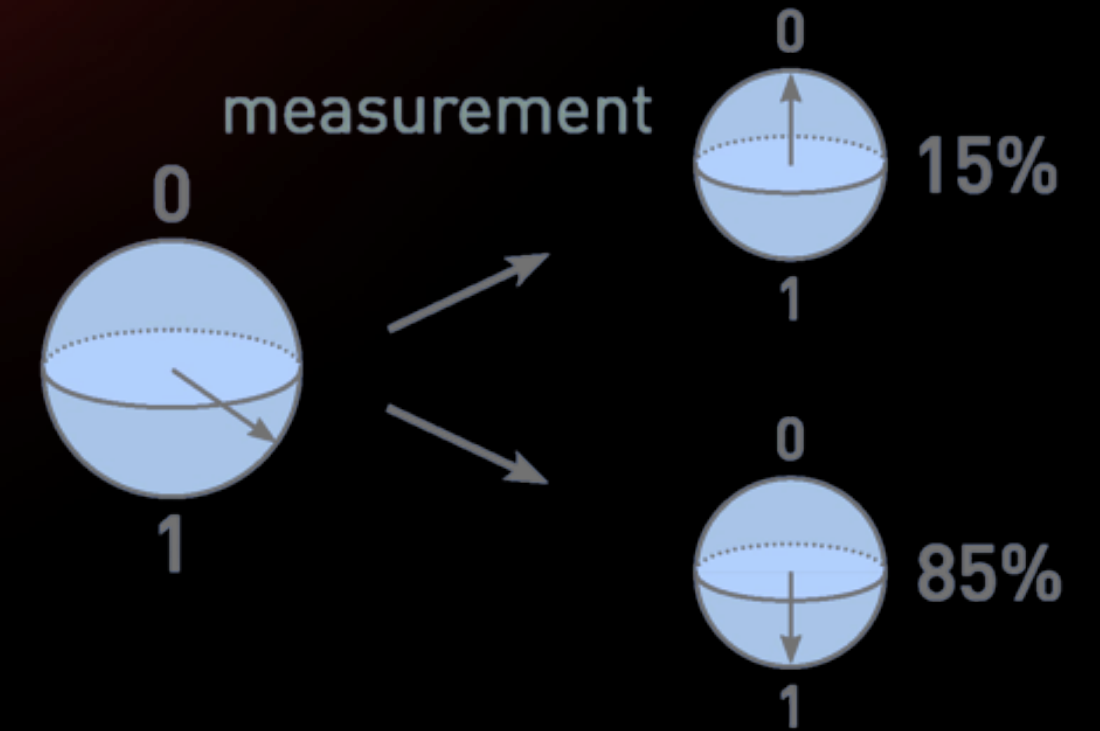
Superposition of a qubit

Entanglement

Entaglement is where two or more qubits become correlated in such a way that the state of one qubit is instantly connected to the state of another, regardless of the distance between tthem. Even Einstein baffingly remarked on this concept as some "**spooky action at a distance**" and is not even explained by classical physics.
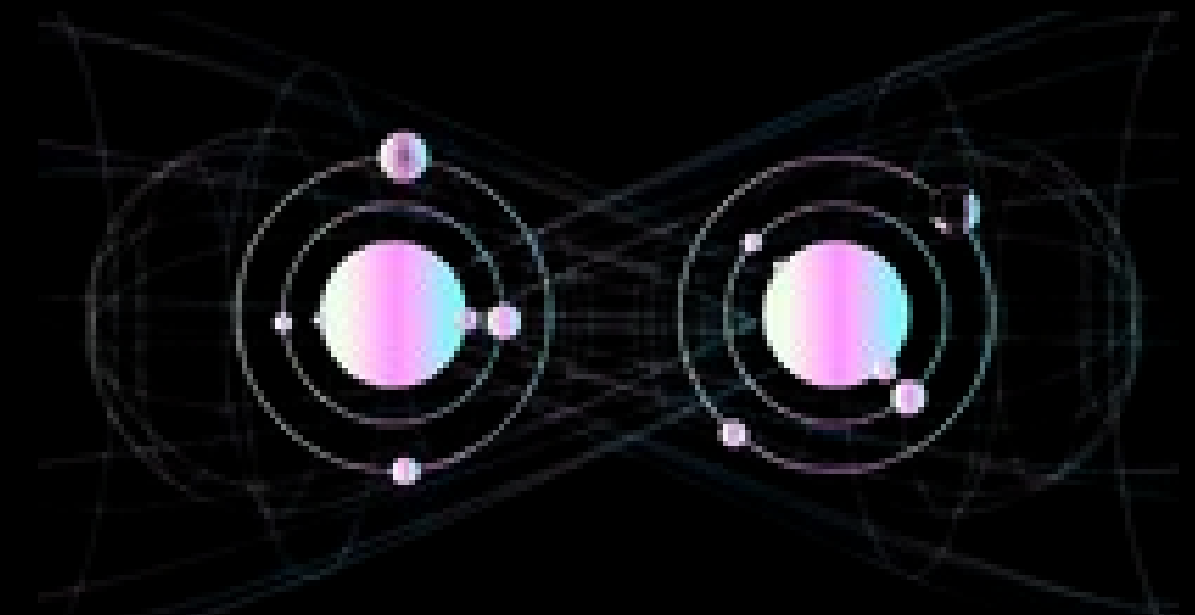
Entanglement state of two qubits

Traditional Computing

- Approaches problems sequentially, executing instructions step by step. Follows deterministic algorithms.

- Excels at tasks involving straightforward calculations, data manipulation and logical operations.

Quantum Computing

- Leverages the principles of superposition and entanglement to explore multiple possibilities simultaneously. Utilizes quatum algorithms to exploit parallel processing capabilities of qubits.

- Solving complex problems that involve a vast number of possibilities such as running micrcosmical simualtions of chemical bonding.

A quantum computer with just 300 qubits could represent a staggering 2^300 (approx. 10^90) states simultaneously. The estimated number of atoms in the observable universe is only around 10^80!

Thank You!