

What is Quantum Computing?

July 10, 2023 • vajiramandravi.com



About Quantum Computing:

- It is an area of computer science that **uses the principles of quantum theory**.
- **Quantum theory explains the behavior of energy and material on the atomic and subatomic levels.**
- Quantum computers have the **capability to sift through huge numbers of possibilities and extract potential solutions to complex problems** and challenges.
- **How does it work?**
 - Where classical computers **store information** as bits with either 0s or 1s, **quantum computers use qubits**.
 - While **classical bits always represent either one or zero**, a **qubit can be in a superposition of one and zero simultaneously** until its state is measured.
 - In addition, the **states of multiple qubits can be entangled**, meaning that they are linked quantum mechanically to each other.
 - **Qubits can be made by manipulating atoms, electrically charged atoms called ions, or electrons, or by nanoengineering so-called artificial atoms**, such as circuits of superconducting qubits, **using a printing method called lithography**.

What is Superposition and Entanglement?

- They are two features of quantum physics **on which quantum computing is based**.
- They **empower quantum computers to handle operations at speeds exponentially higher** than conventional computers **and with much less energy consumption**.
- **Superposition:**
 - **A qubit places the quantum information** that it contains **into a state of superposition**.
 - This refers to a **combination of all possible configurations of the qubit**.
 - **Groups of qubits in superposition can create complex, multidimensional computational spaces**.
 - Complex problems can be represented in new ways in these spaces.
- **Entanglement:**
 - **Pairs of qubits can be made to become entangled**.
 - This means that the **two qubits then exist in a single state**.
 - **In such a state, changing one qubit directly affects the other** in a manner that's predictable.
 - **Quantum algorithms are designed to take advantage of this relationship** to solve complex problems.
 - While doubling the number of bits in a classical computer doubles its processing power, **adding qubits results in an exponential upswing in computing power and ability**.

Q1) What is Quantum Physics?

Quantum physics is the study of matter and energy at the most fundamental level. It aims to uncover the properties and behaviors of the very building blocks of nature.

Source: [Explained | What is Microsoft's planned 'quantum supercomputer'?](#)

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