# ABSTRACT

A quantum computer harnesses some of the almost-mystical phenomena of quantum mechanics to deliver huge leaps forward in processing power. Quantum machines promise to outstrip even the most capable of today’s and tomorrow’s supercomputers.

Quantum computers could spur the development of new breakthroughs in science, medications to save lives, machine learning methods to diagnose illnesses sooner, materials to make more efficient devices and structures, financial strategies to live well in retirement, and algorithms to quickly direct resources such as ambulances.

Today's computers work on bits that exist as either 0 or 1. Quantum computers aren't limited to two states; they encode information as quantum bits, or qubits, which can exist in superposition. Qubits represent atoms, ions, photons or electrons and their respective control devices that are working together to act as computer memory and a processor. Because a quantum computer can contain these multiple states simultaneously, it has the processor that can use registers of qubits will be able to perform calculations using all the possible values of the input registers simultaneously. This superposition causes a phenomenon called quantum parallelism, and is the motivating force behind the research being carried out in quantum computing. Due to technical obstacles, till date, a quantum computer has not yet been realized. But the concepts and ideas of quantum computing has been demonstrated using various methods like NMR, Ion Trap, Quantum Dot, Optical Methods, etc. A quantum computer manipulates qubits by executing a series of quantum gates, each a unitary transformation acting on a single qubit or pair of qubits.  In applying these gates in succession, a quantum computer can perform a complicated unitary transformation to a set of qubits in some initial state.  The qubits can then be measured, with this measurement serving as the final computational result.