

## **Universal Quantum Computing based on Trapped-ion system**

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Understanding, controlling, and utilizing quantum systems have been one of major research interests across fields of physics, chemistry, and material science. In recent years, utilizing quantum mechanical properties – quantum superposition and entanglement enables us to calculate specific tasks exponentially faster than conventional computers and solve problems that might not be solvable otherwise. For example, in theory, a quantum computer can factor a large number faster than any known classical algorithms and significantly increase the speed of searching an item in an unsorted database. While such theoretical approaches toward quantum computation have been pursued extensively over the past several decades, building a universal and practical quantum computer in a laboratory has not been trivial. Because one requires to initialize all qubits, to manipulate them coherently and individually, and to read out their resultant states with extremely high accuracy and precision while the qubits maintain their coherence during the process mentioned above.

In this talk, I would like to introduce basic quantum properties associated with quantum computing and discuss various physical platforms toward building a universal quantum computer. In particular, I would like to focus on the trapped ion system, which individual ions (atoms) are levitated and trapped under ultrahigh vacuum and one utilizes lasers and radio frequency waves in order to perform single qubit gates and two qubit entanglement gates.