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Quantum inside

Quantum computing starts with the idea that information (input) can be stored in the quantum state of a well-controlled quantum mechanical system, often chosen to be a collection of 2-level systems or qubits. Once that is done, unitary time evolution as given by Schrodinger's equation implements logical operations called quantum gates. Finally, measuring the qubits produces (classical) output.

Surprisingly, for specific computational tasks, quantum computing can be more efficient than computing on a classical computer.

The current era of this field of research is called NISQ – noisy intermediate scale quantum computing. Quantum hardware is available but relatively small (up to around 100 qubits) and noisy. This lecture will review some of the many qubit designs and the state of the art of their performance.

The lecture will also discuss the future prospect of FTQC - fault tolerant quantum computing, which uses additional qubits for error correction. FTQC can, in principle, be scaled up to sizes needed for meaningful quantum advantage and applications in science, industry and society.