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High-Fidelity Measurements of Josephson Phase Qubits

JOHN MARTINIS, UC Santa Barbara

The Josephson junction is an ideal solid-state system for building electrical "atoms" that can function as quantum bits for a quantum computer. Recent advances in the materials and design of phase qubits have dramatically improved their coherence, with energy relaxation times as long as 500 ns and, in a separate device, measurement fidelities as high as 90%. Combined with advances in microwave electronics, full characterization of single and coupled qubit gates are now possible using quantum tomographic techniques. I will report on several ongoing experiments in our group: measurement of the evolution of a quantum state from incomplete measurement, violation of Bell's inequality in a coupled qubit, and the implementation and characterization of a CNOT gate.