Addressing the fidelity and scaling challenges of superconducting qubits

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Abstract

We recently discovered a new kind of a superconducting qubit, the unimon [1], that can be fabricated using standard materials and techniques out of a single Josephson junction and a superconducting resonator yet having higher anharmonicity than the transmon and resilience against charge and flux noise. Our first experiments on the unimon demonstrate single-qubit-gate fidelity of 99.9% stable for several hours without recalibration. In addition, we have developed qubit readout, reset, and control electronics that operates at millikelvin temperatures and can be integrated with the unimon in the future [2–6]. Whereas the increased anharmonicity and noise resilience of the unimon seems promising for achieving high-fidelity qubit operations, the integrated millikelvin electronics addresses the scaling challenges of future large-scale superconducting quantum computers.

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