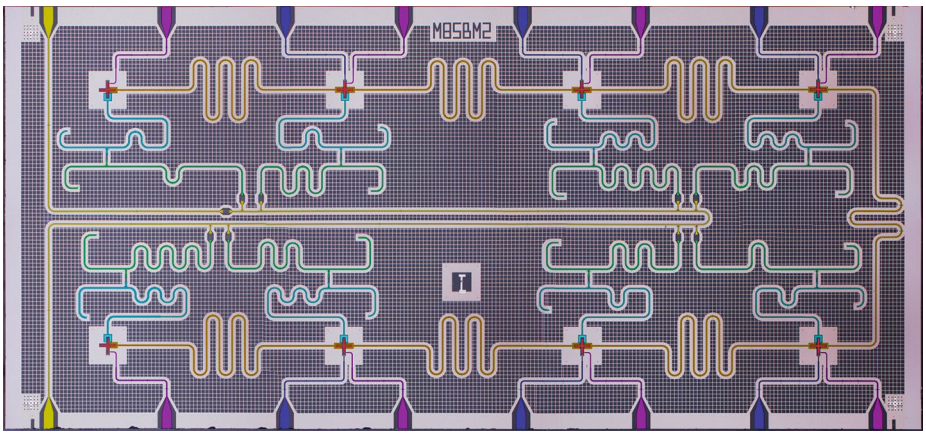
SUPERCONDUCTING QUBITS

Quantum circuits take five

Phys. Rev. Appl. **10**, 034040 (2018)



Credit: APS

The ability to measure and control superconducting qubits while suppressing the decoherence that results from interaction with their environment is an important requirement for scaling quantum information processing systems. A common measurement approach is to couple the qubit to a readout resonator, which can be further enhanced by using Purcell filters. However, the demonstration of fast and accurate methods that enable the measurement of multiple superconducting qubits has so far proved challenging. Johannes Heinsoo and colleagues at ETH Zurich now report a high-speed frequency-multiplexed readout of up to five qubits.

The researchers developed a superconducting chip on which each qubit is coupled to a dedicated resonator and Purcell filter pair, and is connected to a single common readout channel. By optimizing the design parameters of the filters and the resonators, such as the resonator frequency, the architecture is able to minimize off-resonant driving of the non-targeted readouts, thereby minimizing cross-coupling and unintentional dephasing of qubits. Heinsoo and colleagues found that the performance of the simultaneous five-qubit readout is similar to when measuring the qubits individually, illustrating that it is possible to calibrate each qubit separately. The average five-qubit readout fidelity was, in particular, shown to be 97%.

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Published online: 19 November 2018
https://doi.org/10.1038/s41928-018-0169-y