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Flux Qubits and Readout Device with Two Independent Flux Lines[1] B.L.T. PLOURDE, T.L. ROBERTSON, T. HIME, P.A. REICHARDT, C.-E. WU, JOHN CLARKE, University of California, Berkeley — Circuits involving multiple flux qubits require an architecture which is scalable. In particular, the flux bias must be settable for each element individually. We report measurements on two superconducting flux qubits coupled to a readout Superconducting QUantum Interference Device (SQUID). The devices were fabricated with Al-AlOx-Al tunnel junctions using electron-beam lithography. Two on-chip flux bias lines allowed independent flux control of any two of the three elements. By rastering the currents in these two flux lines, we observed the modulation of the SQUID critical current due to the applied flux as well as the changing screening currents in the two qubits. These results are illustrated by a two-dimensional qubit flux map. By varying the flux bias currents to move along a line of constant flux applied to the SQUID, we could measure the qubit transitions while maintaining a fixed SQUID sensitivity. When combined with variable qubit-qubit coupling based on the circulating currents in the readout SQUID, this architecture should be scalable to many qubits and SQUIDs on a single chip.

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