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High fidelity readout of a superconducting qubit using heralded state preparation[1] J.E. JOHNSON, UC Berkeley, C. MACKLIN, D.H. SLICHTER, R. VIJAY, UC Berkeley, QNL, E. WEINGARTEN, JOHN CLARKE, UC Berkeley, I. SIDDIQI, UC Berkeley, QNL — We report measurements of a superconducting flux qubit, coupled via a shared inductance, to a quasi-lumped element 5.78-GHz readout resonator formed by the parallel combination of an interdigitated capacitor and a meander line inductor. A Josephson parametric amplifier with near-quantum-limited noise performance is used to increase the measurement sensitivity. We demonstrate a continuous, high-fidelity readout with sufficient bandwidth and signal-to-noise ratio to resolve quantum jumps in the flux qubit. We achieve a readout fidelity of 91%, limited primarily by T_1 decay between state preparation and measurement. The fast, high-visibility, QND character of the readout allows for many successive readouts within a time T_1. We exploit this capability to herald pure ground and excited state ensemble populations by post-selecting only for certain states after an initial readout. This method enables us to eliminate errors due to imperfect state preparation, increasing the fidelity to 94%. We also present a precise budget of fidelity loss and an analysis of the readout backaction.

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