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Monitoring the state of a superconducting quantum bit using weak measurements[1] CHRIS MACKLIN, R. VIJAY, D.H. SLICHTER, STEVEN WEBER, KATER MURCH, R. NAIK, UC Berkeley, QNL, ALEXANDER N. KOROTKOV, Department of Electrical Engineering, University of California, Riverside, CA 92521, USA, I. SIDDIQI, UC Berkeley, QNL — We demonstrate continuous weak measurement of the state of a superconducting transmon qubit in the circuit QED architecture using a Josephson parametric amplifier. The near quantum-limited noise performance of the amplifier enables us to obtain a high-fidelity measurement record which can be used to reconstruct the qubit state evolution during measurement by employing the quantum Bayesian formalism. While simultaneously driving the qubit at its Larmor frequency and measuring it weakly, we are able to resolve the spectral signature of Rabi oscillations present in the measurement record with a high signal-to-noise ratio (SNR). We discuss current limitations in this measurement scheme and suggest ways to further optimize the SNR. Our results suggest a route to implement quantum feedback to steer the state of a superconducting qubit.

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