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Stabilizing Rabi oscillations in a superconducting qubit using quantum feedback[1] R. VIJAY, CHRIS MACKLIN, 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 — Recent progress in the development of quantum-noise-limited superconducting parametric amplifiers has enabled high-fidelity, continuous measurements of superconducting quantum bits (qubits). We exploit this functionality while leveraging improved coherence times in transmon qubits to show that it is now possible to obtain a faithful record of real-time qubit dynamics during measurement. We weakly measure the qubit while it is continuously driven at the Larmor frequency. The phase of the resulting Rabi oscillations diffuses slowly, primarily due to the measurement. We monitor this phase diffusion and correct for it by feeding back on the qubit drive amplitude. This locks the Rabi oscillations to a classical reference signal and the oscillations persist indefinitely with a reduced visibility set by the feedback efficiency. We perform tomography on the feedback stabilized state and suggest routes to further optimize the feedback efficiency. Such capabilities suggest a measurement based route for implementing continuous quantum error correction.

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