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Experimental demonstration of an oscillator stabilized Josephson flux qubit R. H. KOCH, G. A. KEEFE, F. P. MILLIKEN, J. R. ROZEN, C. C. TSUEI, J. R. KIRTLEY, D. P. DIVINCENZO, IBM Research, Yorktown Heights, NY 10598 — We experimentally demonstrate the use of a superconducting transmission line, shorted at both ends, to stabilize the operation of a tunable flux qubit. Our qubit consists of three Josephson junctions and three loops coupled to a fixed-length superconducting transmission line. The bare qubit has two control parameters, the flux and the control flux. This allows the qubit to have a tunable difference frequency between the ground and first excited states and at the same time to be biased at a degenerate point with respect to the flux parameter. This condition can be met for a wide range of junction critical currents. This flexibility of our structure is a very desirable property for a scalable qubit. To stabilize the operation of our qubit and increase its coherence time, we couple the bare qubit to the lowest mode of a superconducting transmission line, which we model as a harmonic oscillator. Using harmonic oscillator stabilization and pulsed dc operation, we have observed Larmor oscillations with a single shot visibility of 90 percent and a coherence time of 100 ns. In another qubit the visibility was 60 percent and there was no measurable visibility reduction after 35 ns.

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