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Autonomous stabilization of an entangled state of two transmon qubits[1] S. SHANKAR, Z. LEGHTAS, M. HATRIDGE, A. NARLA, U. VOOL, S.M. GIRVIN, Applied Physics Department, Yale University, M. MIRRAHIMI, Applied Physics Department, Yale University and INRIA, Paris-Rocquencourt, M.H. DEVORET, Applied Physics Department, Yale University — Recent circuit QED (cQED) experiments on superconducting transmon qubits have shown good progress towards measurement-based quantum feedback, that should allow the stabilization of interesting quantum states, such as an entangled state of two qubits. These experiments crucially depend on fast, high-fidelity, quantum non-demolition qubit readout using superconducting parametric amplifiers as well as high-speed room-temperature electronics. We describe an alternate autonomous-feedback strategy to stabilize two qubits dispersively coupled to a single cavity into an entangled state, while obviating the need for an optimized measurement chain. The system Hamiltonian is designed to be in the strong dispersive cQED regime where the dispersive shifts of the two qubits are tuned to be equal ($\chi/2\pi = 5$ MHz) and larger than the cavity linewidth ($\kappa/2\pi = 1.5$ MHz). By applying continuous microwave drives at the cavity and qubit frequencies, the system is forced into the desired quantum state. The stabilization rate of this scheme is of order κ which can be made much faster than all decoherence rates $1/T_1$, $1/T_\phi$ that take the system out of the entangled state. We will discuss initial experimental progress towards the goal of autonomous high-fidelity entanglement.

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