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Continuous generation and stabilization of Schrödinger cat states in a quantum circuit[1] A. ROY, Z. LEGHTAS, A.D. STONE, M.H. DEVORET, Department of Applied Physics, Yale University, M. MIRRAHIMI, Department of Applied Physics, Yale University and INRIA Paris Rocquencourt — While dissipation is widely considered as being harmful for quantum coherence, it can, when properly engineered, lead to the stabilization of non-trivial pure quantum states. Deterministic generation of non-classical states like Schrödinger cat states is one of the key ingredients in performing universal quantum computation. We theoretically propose a scheme, adapted to superconducting quantum circuits, for continuous generation and stabilization of these states in a cavity using dissipation engineering. We first generate these states inside a high-Q cavity by engineering its dissipation with a bath that only exchanges photons in pairs. We then stabilize these transient states against single-photon decay using a second engineered bath. The single-photon stabilization is autonomous, and exploits the photon-number-dependent frequency-splitting due to Kerr interactions in the strongly dispersive regime of circuit QED. We present analytical and numerical results demonstrating the robustness of the scheme and its amenability to immediate experimental implementation.

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