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Engineering high-order nonlinear dissipation for quantum superconducting circuits[1] S.O. MUNDHADA, A. GRIMM, S. TOUZARD, S. SHANKAR, Z.K. MINEV, U. VOOL, Department of Applied Physics, Yale University, M. MIRRAHIMI, QUANTIC team, INRIA de Paris; Yale Quantum Institute, Yale University, M.H. DEVORET, Department of Applied Physics, Yale University — Engineering nonlinear driven-dissipative processes is essential for quantum control. In the case of a harmonic oscillator, nonlinear dissipation can stabilize a decoherence-free manifold, leading to protected quantum information encoding. One possible approach to implement such nonlinear interactions is to combine the nonlinearities provided by Josephson circuits with parametric pump drives. However, it is usually hard to achieve strong nonlinearities while avoiding undesired couplings. Here we propose a scheme to engineer a four-photon drive and dissipation in a harmonic oscillator by cascading experimentally demonstrated two-photon processes. We also report experimental progress towards realization of such a scheme.

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