

Abstract Submitted
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Designing a three mode circuit QED experiment BRIAN VLAS-TAKIS, GERHARD KIRCHMAIR, HANHEE PAIK, SIMON NIGG, LUIGI FRUNZIO, STEVEN GIRVIN, MICHEL DEVORET, ROBERT SCHOELKOPF, Yale University — Circuit QED employs the coupling of nonlinear elements to resonant modes of an electronic circuit. We demonstrate that all resonant modes will attain some degree of nonlinearity from even a single nonlinear element. This can result in individually addressable transitions for each mode and allow direct control of each quantum state. Furthermore, we show that the transition frequency of any one mode will depend on the state of all other modes. These state dependent shifts can be used to directly readout the quantum state of one mode probing another. We illustrate this behavior by coupling two three-dimensional resonators to a superconducting transmon qubit and present a method to determine the Hamiltonian for this system using a nonlinear circuit QED model.

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