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Multi-Resonator Circuit QED Part I: The Photon Shell[1] MATTEO MARIANTONI, H. WANG, RADOSLAW C. BIALCZAK, M. LENANDER, ERIK LUCERO, M. NEELEY, A.D. O'CONNELL, D. SANK, M. WEIDES, J. WENNER, T. YAMAMOTO, Y. YIN, J. ZHAO, JOHN M. MARTINIS, A.N. CLELAND, Department of Physics, UC Santa Barbara — The generation and control of quantum states of light constitute fundamental tasks in cavity quantum electrodynamics (QED). The superconducting realization of cavity QED, circuit QED, enables on-chip microwave photonics, where superconducting qubits control and measure individual photon states. A long-standing issue in cavity QED is the coherent transfer of photons between two or more resonators. Here, we use circuit QED to implement a three-resonator architecture on a single chip, where the resonators are interconnected by two superconducting phase qubits. We use this circuit to shuffle one- and two-photon Fock states between the three resonators, and demonstrate qubit-mediated vacuum Rabi swaps between two resonators. This illustrates the potential for using multi-resonator circuits as photon quantum registries and for creating multipartite entanglement between delocalized bosonic modes.

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