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Controlled release of cavity states into propagating modes induced via a single qubit WOLFGANG PFAFF, MARIUS CONSTANTIN, MATTHEW REAGOR, CHRISTOPHER AXLINE, JACOB BLUMOFF, KEVIN CHOU, ZAKI LEGHTAS, STEVEN TOUZARD, REINIER HEERES, PHILIP REINHOLD, NISSIM OFEK, KATRINA SLIWA, LUIGI FRUNZIO, Yale University, MAZYAR MIRRAHIMI, Yale University INRIA, KONRAD LEHNERT, University of Colorado, LIANG JIANG, MICHEL DEVORET, ROBERT SCHOELKOPF, Yale University — Photonic states stored in long-lived cavities are a promising platform for scalable quantum computing and for the realization of quantum networks. An important aspect in such a cavity-based architecture will be the controlled conversion of stored photonic states into propagating ones. This will allow, for instance, quantum state transfer between remote cavities. We demonstrate the controlled release of quantum states from a microwave resonator with millisecond lifetime in a 3D circuit QED system. Dispersive coupling of the cavity to a transmon qubit allows us to enable a four-wave mixing process that transfers the stored state into a second resonator from which it can leave the system through a transmission line. This permits us to evacuate the cavity on time scales that are orders of magnitude faster than the intrinsic lifetime. This Q-switching process can in principle be fully coherent, making our system highly promising for quantum state transfer between nodes in a quantum network of high-Q cavities.

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