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Varying Cavity Quality Factor in situ for a Transmon in Circuit QED ANDREI PETRENKO, ADAM SEARS, GERHARD KIRCHMAIR, HANHEE PAIK, LUYAN SUN, GIANLUIGI CATELANI, LEONID GLAZMAN, ROBERT SCHOELKOPF, Yale University — Superconducting transmon qubits have recently been studied within 3D cavities. In addition to increasing the coherence times of the qubits this has enabled a simple scheme for varying the quality factor Q (or decay rate κ) of a cavity in situ. This decay rate plays an important role in our understanding of a number of effects in circuit quantum electrodynamics, many of which have direct bearing on qubit decoherence processes. Here we study how adjusting the cavity Q affects the coherence times of a single qubit within the 3D architecture. We demonstrate that varying the coupling enables us to not only examine the limitations of qubit T_1 due to the Purcell Effect, but also probe new decoherence mechanisms such as the dephasing due to photon shot noise. By understanding and minimizing these effects, we obtain record coherences times T_2 and T_2^{Echo} of $\sim 27\mu s$ and $\sim 47\mu s$ respectively.

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