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Approaching 10 Milliseconds for Aluminum Cavities in the Quantum Regime MATTHEW REAGOR, HANHEE PAIK, GIANLUIGI CATELANI, LUYAN SUN, CHRISTOPHER AXELINE, TERESA BRECHT, JACOB BLUMOFF, LUIGI FRUNZIO, LEONID GLAZMAN, ROBERT SCHOELKOPF, Department of Physics and Applied Physics, Yale University — One of the most promising solid state quantum computing architectures couples superconducting qubits to microwave resonators (circuit QED), a system in which three-dimensional microwave cavities have become a valuable resource. Participation-ratio calculations predict at least four orders of magnitude longer lifetimes in 3D cavities than their planar resonator counterparts with equal material losses. Motivated by this principle, we report multiple superconducting aluminum cavities with lifetimes on the order of 10ms at single photon power and millikelvin temperatures. We also present details on extracting the materials properties and the noise performance of a long lived superconducting cavity resonator, including bounds on the intrinsic dephasing time (T_ϕ) of such a resource.

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