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Superconducting Coplanar Waveguide Resonators For A Hybrid Rydberg Atom-Superconductor Interface MATTHEW BECK, JONATHAN PRITCHARD, JOSHUA ISAACS, MARK SAFFMAN, ROBERT MCDERMOTT, University of Wisconsin, Madison — Superconducting qubits achieve fast gate times (~ 1 ns); however, coherence times are relatively short (~ 10 μs). In contrast, atomic qubits based on Rydberg atoms achieve long coherence times of order 1 s, but are limited by slow gate times (~ 1 μs). Combining these disparate technologies in a hybrid quantum processor would provide both a long-lived memory and the ability to run computations quickly. Here we describe the design, fabrication, and characterization of superconducting coplanar waveguide resonators optimized to achieve strong coupling between the resonator mode and a single trapped Cs Rydberg atom. We discuss the dependence of resonator quality factor and coupling strength on device geometry and describe the integration of superconducting thin-film processing with MEMS-style thick film fabrication in order to increase the spatial extent of the resonator's electric field.

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