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A Rydberg/cavity QED apparatus for exploring polariton blockade ALEXANDROS GEORGAKOPOULOS, ALBERT RYOU, NINGYUAN JIA, NATHAN SCHINE, Univ of Chicago, ARIEL SOMMER, MIT, JONATHAN SIMON, Univ of Chicago — In this work, we present the technical advances that have enabled us to explore Rydberg-mediated Interactions between resonator photons. In particular, we describe an exotic resonator geometry that enables us to maintain the small mode waist essential for exploring blockade physics, while keeping all material surfaces nearly a full cm away from the electric-field sensitive Rydbergs. We achieve stray fields stable at the 10mV/cm level over a day, in spite of the presence of a high-voltage piezo actuator to stabilize the resonator length to the few angstrom level. This enables us to employ 87Rb Rydbergs in the n=*1*21S quantum state, with a DC polarizability of nearly 24GHz/(v/cm)ˆ2, for our cavity Rydberg EIT experiments, thereby reaching the blockaded regime, indicating strong interactions between individual photons. We will also explore prospects for pushing these experiments into a multimode regime where dissipative manybody pumping will allow us to explore crystals and topological fluids of photons.

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