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Interfacing Collective Atomic Excitations and Single Photons JONATHAN SIMON, HARUKA TANJI, JAMES THOMPSON, VLADAN VULETIC, MIT/Harvard Center for Ultracold Atoms — A variety of quantum communication and computing schemes rely on the storage and transfer of single photonic excitations. We demonstrate generation, storage, and adiabatic transfer of such excitations, using ensembles of Cs atoms within a low finesse optical resonator as a storage medium. We explore theoretical and practical limitations on read-out, experimentally realizing a peak atomic-photonic conversion efficiency of .84(11). The storage in the system exhibits two doppler times, which can be understood in terms of long- and short- wavelength spin gratings simultaneously written into the atomic ensemble. We demonstrate cavity mediated transfer of a quantized atomic excitation between atomic ensembles within the same optical resonator. These results pave the way towards a practical single photon generation and storage apparatus, useful in quantum communication, computation, and beyond. This work was supported in parts by the NSF, DARPA, and ARO.

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