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Storage and retrieval of single photons transmitted between remote quantum memories STEWART D. JENKINS, THIERRY CHANELIÈRE, DZMITRY MATSUKEVICH, SHAU-YU LAN, ODELL A. COLLINS, ALEX KUZMICH, T.A. BRIAN KENNEDY, School of Physics, Georgia Institute of Technology — We report the generation, transmission, storage, and retrieval of single photons using two remote atomic ensembles. A single photon is generated from a cold atomic ensemble at one site [1], and is redirected through an optical fiber to another site. The photon is then converted into a single collective atomic excitation using the dark-state polariton approach [2]. After a programmable storage time, the excitation is converted back into a single photon. A reduction in retrieval efficiency is observed as the storage time as increased. This can be understood by generalizing the dark-state polariton theory to account for Zeeman degeneracy and the presence of an ambient magnetic field. During the storage process, the atomic hyperfine coherences rotate, leading to a variation in the dark- state polariton number. For uniform magnetic fields, we predicted and later observed collapses and revivals in the retrieval efficiency for varying storage times.

[1] L.-M. Duan, M. D. Lukin, J. I. Cirac, and P. Zoller, Nature **414**, 413 (2001)
[2] M. Fleischhauer and M. D. Lukin, Phys. Rev. Lett. **84**, 5094 (2000)

Stewart D. Jenkins
School of Physics, Georgia Institute of Technology

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