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Towards a Quantum Memory for Photons in Erbium Doped Materials SARA HASTINGS-SIMON, University of Geneva, MATTHIAS STAUDT, BARBARA KRAUS, WOLFGANG TITTEL, MIKAEL AFZELIUS, NICOLAS GISIN, University of Geneva, IGNACIO CIRAC, Max Planck Institute for Quantum Optics, MATTIAS NILSSON, STEFAN KROLL, Lund Institute of Technology — Quantum memories for single photons could play an important role in quantum communication and optical quantum computing. We present a proposal for the efficient storage and recall of photonic time-bin qubits, based on reversible absorption in a controllably broadened homogeneous absorption line. We report on the first experimental steps towards the realization of this quantum memory protocol. In particular, we have measured the homogenous lifetime of the relevant optical transition in erbium doped optical fibers and erbium doped lithium niobate waveguides by spectral hole burning and photon echo. We have also observed the controlled reversible broadening of spectral holes and spectral hole line shifts due to the Stark effect.

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