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A single-atom quantum memory ANDREAS REISERER, HOLGER SPECHT, CHRISTIAN NOELLEKE, MANUEL UPHOFF, EDEN FIGUEROA, STEPHAN RITTER, GERHARD REMPE, Max-Planck-Institute of Quantum Optics, Garching, Germany — A prerequisite for the realization of quantum networks is a coherent and reversible interface between flying and stationary qubits. So far, most experiments have been based on the exchange of information between photons and collective atomic excitations. A promising alternative is the development of an interface between single photons and a single atom, employing an optical cavity to achieve sufficient coupling strength. This approach has fundamental advantages, as it allows for the individual manipulation of the atomic qubit and the implementation of a nondestructive heralding scheme based on a measurement of the atomic hyperfine state. In our experiment, a single rubidium atom is trapped inside a cavity in the intermediate coupling regime of cavity QED. The storage of a photon impinging onto the system is achieved by a stimulated Raman adiabatic passage mediated by an appropriate control laser pulse driving the atom. The polarization state of the photon is unambiguously mapped onto the internal Zeeman state of the atom. After a variable storage time, the atomic state is read out by producing a single photon, thereby recreating the initial polarization state.

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