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A passive, heralded, quantum memory with crossed fiber cavities DOMINIK NIEMIETZ, Max Planck Institute of Quantum Optics, MANUEL BREKENFELD, Menlo Systems GmbH, JOSEPH DALE CHRISTESEN, National Institute of Standards and Technology, GERHARD REMPE, Max Planck Institute of Quantum Optics — Quantum memories have been implemented in various physical systems ranging from atoms to solids, and from ensembles to single emitters. Despite progress, a large challenge concerns the always present photon loss and the always finite efficiency. Both limitations can be remedied with a herald that signals successful operation of the quantum memory. We have set up a new experiment with single neutral atoms trapped at the center of two crossed Fabry-Perot fiber cavities. Exploiting the possibilities given by the new system, we have realized a quantum memory for photonic polarization qubits which provides a herald that signals successful storage without destruction of the employed qubit [1]. In addition, the memory couples to two spatially and spectrally distinct cavity modes. One mode is used for sending in and reading out the photonic qubit. The second mode replaces amplitude- and phase-critical control fields including no need for feedback-loops, rendering this memory fully passive. Our memory is robust and fits naturally into a fiber-based network. Therefore it is an important step towards the goal of realizing a practical quantum repeater [2].

[1]Brekenfeld et al, accepted in **Nat. Phys.** (2020)
[2]Uphoff et al, **Appl. Phys. B** 122, 46 (2016)

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