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Optimization of a Quantum Memory with Telecom-Wavelength Conversion DANIEL STACK, US Army Rsch Lab - Adelphi, IAN GRISSOM, PRISCILLA TANG, University of Maryland-College Park, PATRICIA LEE, QUDSIA QURAISHI, US Army Rsch Lab - Adelphi — Quantum networks provide conduits capable of transmitting quantum information that connect to nodes at remote locations where the quantum information can be stored or processed. Fiber-based transmission of quantum information over long distances may be achieved using quantum memory elements and quantum repeater protocols. We report on progress towards a quantum memory based on the generation of off-axis, spontaneously emitted single photons by a 795 nm write-laser beam interacting with a cold ^{87}Rb ensemble. The detection of a single photon heralds the creation of a spin wave in the atomic cloud. Single photons associated with undesirable optical transitions are filtered out by an ^{85}Rb vapor cell filled with a buffer gas whose optical density is augmented with light induced atom desorption (LIAD) and heating. The photons are converted into the telecom band by difference frequency generation in a PPLN crystal and sent down a long optical fiber. The atomic state is read out via the interaction of a read-pulse with the quantum memory. With such a system, it will be possible to realize a long-lived quantum memory that will allow transmission of quantum information over many kilometers with high fidelity, essential for a scalable, long-distance quantum network.

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