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Room Temperature Memory for Few Photon Polarization Qubits
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— We have developed a room temperature quantum memory device based on Electromagnetically Induced Transparency capable of reliably storing and retrieving polarization qubits on the few photon level. Our system is realized in a vapor of ^{87}Rb atoms utilizing a Λ-type energy level scheme. We create a dual-rail storage scheme mediated by an intense control field to allow storage and retrieval of any arbitrary polarization state. Upon retrieval, we employ a filtering system to sufficiently remove the strong pump field, and subject retrieved light states to polarization tomography. To date, our system has produced signal-to-noise ratios near unity with a memory fidelity of $>80\%$ using coherent state qubits containing four photons on average. Our results thus demonstrate the feasibility of room temperature systems for the storage of single-photon-level photonic qubits. Such room temperature systems will be attractive for future long distance quantum communication schemes.

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