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Noise Reduction in EIT Quantum Memories based Cs Atoms LIJUN MA, OLIVER SLATTERY, XIAO TANG, National Institute of Standards and Technology, QUANTUM COMMUNICATION PROJECT TEAM — Electromagnetically induced transparency (EIT) is a widely used approach for quantum memories. In an EIT-based quantum memory, a strong residual control beam comes out together with a read-out signal at single-photon level. The strong residual control beam becomes a main noise source in the system. Noise reduction becomes critical for the quantum memory because noise reduces the quantum information fidelity. For an operational EIT quantum memory, the strong residual power of the control beam must be greatly reduced. In an EIT quantum memory based on warm atoms, the signal and control beams propagate in the same direction, and with very small frequency difference, so noise reduction becomes a very challenging issue. To solve this problem, three types of filtration including a polarization filter, an F-P etalon filter and an optically pumped absorption atomic filter have been developed in our lab. The overall noise reduction reaches 125 dB, which satisfies the requirement of quantum memory applications. By using the developed filtration elements, our quantum memory successfully demonstrated storage and retrieval of quantum signals at a single photon level with high fidelity.

Xiao Tang
National Institute of Standards and Technology

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