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Simple and Efficient Single Photon Filter for a Rb-based Quantum Memory DANIEL STACK, Army Research Laboratory, XIAO LI, Joint Quantum Institute, QUDSIA QURAISHI, Army Research Laboratory — Distribution of entangled quantum states over significant distances is important to the development of future quantum technologies such as long-distance cryptography, networks of atomic clocks, distributed quantum computing, etc. Long-lived quantum memories and single photons are building blocks for systems capable of realizing such applications. The ability to store and retrieve quantum information while filtering unwanted light signals is critical to the operation of quantum memories based on neutral-atom ensembles. We report on an efficient frequency filter which uses a glass cell filled with ^{85}Rb vapor to attenuate noise photons by an order of magnitude with little loss to the single photons associated with the operation of our cold ^{87}Rb quantum memory. An Ar buffer gas is required to differentiate between signal and noise photons or similar statement. Our simple, passive filter requires no optical pumping or external frequency references and provides an additional 18 dB attenuation of our pump laser for every 1 dB loss of the single photon signal. We observe improved non-classical correlations and our data shows that the addition of a frequency filter increases the non-classical correlations and readout efficiency of our quantum memory by $\approx 35\%$.

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