Abstract Submitted
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**An Approach for trapped Ba+ ion-photon entanglement and quantum frequency conversion** JAMES SIVERNS, XIAO LI, Joint Quantum Institute, Univ of MD, College Park, 20742, QUDSIA QURAISHI, Army Research Lab and Joint Quantum Institute, University of MD, 20742, ARL/JQI COLLABORATION — Networking remotely situated trapped ion quantum memories involves the extraction, propagation and detection of photons which are entangled with internal qubit states of an ion [1]. Given the cumulative losses of these processes it is important to have a high-probability method to extract the photon. Even with high probability photon extraction, extending the networking range is challenging as the flying qubit's wavelength is severely attenuated when propagated in optical fiber. In this case, quantum frequency conversion has been proposed as an approach to extend the networking range. Here, we compare several methods of ion–photon entanglement generation, including strong and weak excitation methods, showing the fidelity and entanglement probability vary as a function of the photon collection optic's numerical aperture. We project that the highest photon generation probability (approximately 95%) in 138Ba+ is achieved via shelving to a long-lived, low-lying D-state with a projected fidelity of approximately 89% [2]. We then outline an approach for quantum frequency conversion of the extracted photon, with a view to hybrid or long-distance networking, useful for extending the range of ion-based quantum networks and hybrid quantum networks compromised of different types of quantum memories. [1] C. Monroe, et. al., Phys. Rev. A 89, 022317 (2014). [2] J. Siverns, X. Li and Q. Quraishi, App. Opt. 56, 3, B222 (2017).

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