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Telecom and Rubidium Resonant Single Photons from a Barium Ion Via Quantum Frequency Conversion JOHN HANNEGAN, JAMES SIVERNS, Joint Quantum Institute, QUDSIA QURAISHI, Army Research Laboratory — Trapped ions typically emit short wavelength photons with limited propagation range due to substantial attenuation in optical fibers. To extend the transmission range of photons from trapped Ba^+ ions, quantum frequency conversion (QFC) in a nonlinear crystal allows for translation of the ion's native wavelength to a more desirable wavelength. The conversion is performed in a periodically poled lithium niobate waveguide via difference frequency generation between the ion's photon and a high intensity pump. Ba^+ has two strong optical dipole transitions which produce visible photons at 650 nm and 493 nm. Here, we show single stage conversion of 650 nm Ba^+ resonant laser light to the telecom O-Band (1259 nm). We also show single stage conversion of single 493 nm photons from a $^{138}Ba^+$ ion to 780 nm and, via measurement with a wavemeter, confirm its resonance with ^{87}Rb [1]. Finally, we show two-stage conversion of single 493 nm photons to the telecom C-Band near 1550 nm. We discuss the tunability and optimization of the conversion setup, as well as signal-to-noise at the single photon level. These results, as well as QFC results using Ca^+ [2,3] provides a pathway for remote inter-ion quantum networking and possible hybrid networking. [1] J.D. Siverns, J. Hannegan, Q. Quraishi, arXiv:1801.01193 (2018) [2] T. Walker, et. al., arXiv:1711.09644 (2017) [3] M. Bock, et. al., arXiv:1710.04866 (2017)

John Hannegan
Joint Quantum Institute

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