

Abstract Submitted  
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**Quantum Communication via Frequency Upconversion**<sup>1</sup> AARON VANDEVENDER, PAUL KWIAT, University of Illinois at Urbana-Champaign — We describe a method for efficiently and coherently converting photonic qubits from one frequency to another for quantum communication. The conversion is done using quasi-phase-matched up-conversion in a Periodically Poled Lithium Niobate (PPLN) crystal. We have observed 99%-efficient and 95%-coherent conversion which allows faithful conversion of “flying” qubits to “stationary” qubits for use in quantum communication. We have also used up-conversion to prepare photons in arbitrary superpositions of widely separated frequency states, enlarging the accessible Hilbert space for communication of quantum states. Finally, we have seen 56%-efficient detection of 1550-nm photons using up-conversion to the visible and silicon Avalanche Photodiodes (APD), which would enhance the performance of quantum communication protocols (e.g., BB84) based on infrared (IR) photons over what is achievable with conventional IR single-photon detectors.

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