Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

SuperDense Teleportation for Space Applications TRENT GRAHAM, Department of Physics, University of Illinois at Urbana-Champaign, HERBERT BERNSTEIN, School of Natural Science & ISIS Institute for Science and Interdisciplinary Studies, Hampshire College, HAMID JAVADI, Jet Propulsion Laboratory, California Institute of Technology, PAUL KWIAT, Department of Physics, University of Illinois at Urbana-Champaign — The transfer of quantum information over long distances is needed for many quantum communication protocols. Unfortunately, loss and noise make it difficult to directly transmit quantum states between two distant parties. Entanglement-enhanced state communication techniques such as quantum teleportation and remote state preparation allow two remote parties with shared entanglement to exchange quantum states using classical communication. However, these techniques require extensive resources and complicated measurements to implement deterministically. In contrast, SuperDense Teleportation (SDT) can communicate quantum states deterministically with greatly reduced resources, which makes it ideal for communicating quantum information for space applications. We are implementing a SDT lab demonstration, using polarization- and time-mode entangled photons to communicate a special set of two-qubit, single-photon states between two parties. We will then investigate the possibility of a space-to-Earth implementation. I will discuss our experimental progress and the design challenges facing a practical demonstration of satellite-to-Earth SDT as well as possible extensions for measuring relativistic effects on entangled states.

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Date submitted: 29 Jan 2015 Electronic form version 1.4