Abstract Submitted
for the DAMOP08 Meeting of
The American Physical Society

Four-wave mixing in a birefringent semiconductor waveguide for correlated photon generation DANIEL ROGERS, Joint Quantum Institute, NIST and University of Maryland, Gaithersburg, MD, JULIUS GOLDHAR, Electrical and Computer Engineering Department, University of Maryland, College Park, MD, CHRISTOPHER RICHARDSON, Laboratory for Physical Sciences, University of Maryland, College Park, MD, ALESSANDRO RESTELLI, JOSHUA BIENFANG, CHARLES CLARK, Joint Quantum Institute, NIST and University of Maryland, Gaithersburg, MD — The next generation of optical devices for everything from communications to metrology will depend on a fast and practical source of entangled photon pairs. Current methods of entanglement, whether in bulk nonlinear crystals or microstructure optical fibers, pose significant challenges to integration into larger optical systems. In order to meet the demands for speed and practicality, we investigate third-order nonlinearity in a semiconductor waveguide as a source of correlated and ultimately entangled photon pairs. The source is potentially useful for free-space and fiber-optic quantum key distribution as well as a host of other applications such as correlated photon metrology and two-photon interferometry. Analysis of the effectiveness of birefringent phase matching will also provide some measure of the anisotropy of the third-order nonlinear response in III-V compound semiconductors, a significant unknown in nonlinear optics. We show the feasibility of using phase-matched four-wave mixing in a birefringent AlGaAs waveguide to generate correlated photon pairs at wavelengths compatible with silicon detectors.

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Date submitted: 31 Jan 2008 Electronic form version 1.4