Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Ultra-Low Power Cross-Phase Shifts using Metastable Xenon in a High-Finesse Cavity[1] GARRETT HICKMAN, TODD PITTMAN, JAMES FRANSON, University of Maryland, Baltimore County — Many important applications in quantum information and quantum communications make use of weak single-photon nonlinearities. These nonlinearities have been produced using a number of methods, but they generally require a complicated experimental setup. We demonstrate a relatively simple system for producing ultra-low power cross-phase modulation, by using metastable xenon as the nonlinear medium within an optical cavity. Using metastable xenon prevents the degradation of optical surfaces which typically occurs with the use of alkali vapors such as rubidium. We produce phase shifts of up to 10 mrad using 4.5-fJ control pulses. We discuss the performance of this system and outline the planned improvements that will allow the cavity to produce single-photon phase shifts on the order of 1 mrad.

[1]This work was supported in part by DARPA DSO Grant No. W31P4Q-12-1-0015 and by NSF Grant No. PHY-1402708.

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Date submitted: 02 Nov 2015 Electronic form version 1.4