Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Impossibility of large phase shifts via the "giant Kerr effect" with single-photon wavepackets[1] JULIO GEA-BANACLOCHE, University of Arkansas — For a system of two single-photon wavepackets interacting via an ideal, localized Kerr medium, it is shown that, because of spontaneous emission into the initially unoccupied temporal modes, the cross-phase modulation in the Schrödinger picture is very small as long as the spectral width of the single-photon pulses is well within the medium's bandwidth. In this limit, the Hamiltonian used can be derived from the "giant Kerr effect" for a four-level atom, under conditions of electromagnetically-induced transparency; it is shown explicitly that the linear absorption in this system increases as the pulse's spectral width approaches the medium's transparency bandwidth, and hence, as long as the absorption probability remains small, the maximum cross-phase modulation is limited to essentially useless values. These results are in agreement with the general, causality- and unitarity-based arguments of Shapiro and co-workers.

[1]Research supported by the NSF

Julio Gea-Banacloche
University of Arkansas

Date submitted: 21 Jan 2010 Electronic form version 1.4