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Conditional phase shift between single photon pulses with different velocities in a Kerr medium BALAKRISHNAN VISWANATHAN, JULIO GEA-BANACLOCHE, University of Arkansas — Spectral entanglement is a potentially significant obstacle to the eventual realization of quantum logical gates at the single-photon level using optical nonlinearities [1]. It has recently been pointed out [2] that this unwanted effect can be virtually eliminated by setting up a situation where conservation of momentum and energy lead to non-equivalent algebraic conditions on the wavevectors and frequencies of the interacting photons. We verify that this may be the case, in principle, for two photons traveling through a nonlocal Kerr medium with different velocities (co- or counterpropagating). The role of the nonlocality is merely to make the theory well behaved, and is essentially equivalent to a truncation of the medium's bandwidth, as we also verify here.

[1]J Gea-Banacloche, Phys. Rev. A **81**, 043823 (2010)
[2]D. J. Brod, J. Combes, and J. Gea-Banacloche, Phys. Rev. A **94**, 023833 (2016)

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