

Abstract Submitted
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Single-photon Kerr nonlinearities help quantum computation

JOSHUA COMBES, University of Queensland, BROD DANIEL, Perimeter Institute for Theoretical Physics — There is still much debate over whether it is actually possible to build a CPHASE gate using fully realistic models for cross-Kerr nonlinearities. The main contention is that the multimode nature of traveling photons precluded a high-fidelity CPHASE gate. This was pointed in two well-known results, due to Shapiro and Gea-Banacloche. In this talk, I will describe our proposal [1] for a high-fidelity CPHASE gate built out of networks of cross-Kerr interaction sites and counter-propagating photons. In the limit of infinitely many interaction sites and spectrally narrow wave packets, this network implements a perfect CPHASE gate [2]. Our proposal is fully passive - there is no need for active switching, error correction, gradient echo memories, wave packet reshaping, etc. Further, it is less resource-intensive than previous proposals. [1] D. J. Brod and J. Combes, Phys. Rev. Lett. 117, 080502 (2016). [2] D. J. Brod, J. Combes, and J. Gea-Banacloche, Phys. Rev. A 94, 023833(2016).

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