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Photonic Phase Gate via an Exchange of Fermionic Spin Waves in a Spin Chain ALEXEY GORSHKOV, Harvard University, JOHANNES OTTERBACH, Technische Universitat Kaiserslautern, EUGENE DEMLER, Harvard University, MICHAEL FLEISCHHAUER, Technische Universitat Kaiserslautern, MIKHAIL LUKIN, Harvard University — We propose a new protocol for implementing the two-qubit photonic phase gate. In our approach, the π phase is acquired by mapping two single photons into atomic excitations with fermionic character and exchanging their positions. The fermionic excitations are realized as spin waves in a spin chain, while photon storage techniques provide the interface between the photons and the spin waves. Possible imperfections and experimental systems suitable for implementing the gate are discussed. [Reference: arXiv:1001.0968]

Alexey Gorshkov
Harvard University

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