Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Electron-Hole Entanglement in a Quantum Spin Hall Insulator KOJI SATO, Tohoku Univ, MIRCEA TRIF, YAROSLAV TSERKOVNYAK, University of California, Los Angeles — We demonstrate that entangled electron-hole pairs can be produced and detected in a quantum spin Hall insulator with a constriction that allows for a weak inter-edge tunneling. A violation of a Bell inequality, which can be constructed in terms of low-frequency nonlocal current-current correlations, serves as a detection of the entanglement. We show that the maximum violation of a Bell inequality can be naturally achieved in this setup, without a need to fine tune tunneling parameters. This may provide a viable route to producing spin entanglement in the absence of any correlations and pairing, where spin-to-charge conversion is enabled by the helical edge structure of a quantum spin Hall insulator.

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Date submitted: 13 Nov 2013 Electronic form version 1.4