Abstract Submitted
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Cooper Pair Injection into Topological Insulators KOJI SATO, University of California, Los Angeles — We theoretically study tunneling of Cooper pairs (CP's) from a superconductor spanning a two-dimensional topological insulator strip into its helical edge states. The coherent low-energy electron-pair tunneling sets off positive nonlocal current cross-correlations along the edges, which reflect an interplay of two quantum-entanglement mechanisms. First of all, superconducting spin pairing dictates a CP partitioning into the helical edge liquids, which transport electrons in the opposite directions for opposite spin orientations. Luttinger-liquid (LL) correlations for the electron-density fluctuations are, furthermore, forcing paired electrons to enter into opposite insulator-strip edges, revealing CP spin entanglement in the inter-edge current correlations. At the same time, the LL behavior, in the absence of Fermi-liquid leads, fractionalizes electrons injected at a given edge into counter-propagating charge pulses carrying definite fractions of the elementary electron charge. The superconductivity as well as LL correlations thus introduce positive current cross-correlations, which reveal a wealth of information about both subsystems. Sato, Loss, Tserkovnyak, arXiv:1003.4316v1. To be published in Physical Review Letters

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