

Abstract Submitted  
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**Topological protection from random Rashba spin-orbit backscattering: Ballistic transport in a helical Luttinger liquid**<sup>1</sup> HONG-YI XIE, Rice Univ, HEQIU LI, Zhejiang University, YANG-ZHI CHOU, MATTHEW FOSTER, Rice Univ — Rashba spin-orbit coupling enables irrelevant backscattering in a time-reversal symmetric helical Luttinger liquid (HLL). We study the Landauer conductance  $G$  of a HLL in the presence of random Rashba coupling as well as the density-density (Luttinger) interaction. We prove that the transport is purely ballistic ( $G = e^2/h$ ) at any temperature due to the topology. The solution involves a unitary transformation that corresponds to a spin-1/2 in a random, two-component time-dependent magnetic field that preserves the projection of the spin along one fluctuating component (integrable dynamics). Our result is exact for a fixed realization of disorder, and avoids difficulties that arise in disorder-averaged perturbative calculations such as bosonization. We compare the HLL with random Rashba coupling to the Dyson model describing an ordinary spinless quantum wire with particle-hole symmetry, which exhibits non-ballistic transport even at zero temperature.

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