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Nonequilibrium Spectroscopy of Topological Edge Liquids ALEX LEVCHENKO, STANISLAV APOSTOLOV, Michigan State University — We develop theory for the energy and spatially resolved tunneling spectroscopy of the topological quantum spin Hall helical states driven out of equilibrium. When helical liquid is constrained between two superconducting reservoirs transport at the edge is governed by the multiple Andreev reflections. The resulting distribution functions of the edge channels exhibit multiple discontinuities at the subgap energies with the periodicity of an applied voltage. The combined effect of interactions and disorder leads to the inelastic backscattering processes mixing different helicity modes thus causing smearing of these singularities. If equilibration is strong then distribution functions of the edge channels collapse into a single Fermi-like function with an effective temperature determined by the superconducting gap, applied voltage and interaction parameter. We conclude that mapping out nonequilibrium distribution function in the experiments may provide valuable information about the relevant perturbations that spoil ballistic edge transport.

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