Transmission line approach to transport of heat in chiral and drift-diffusion systems with dissipation

Eugene Sukhorukov and Florian Stabler

University of Geneva, Department of Theoretical Physics, 24, quai Ernest Ansermet, CH1211, Geneva, Switzerland

Measurements of the energy relaxation in the integer quantum hall edge at filling factor ν=2 suggest the breakdown of heat current quantization [H. le Sueur et al., Phys. Rev. Lett. 105, 056803]. It was shown, in a hydrodynamic model, that dissipative neutral modes contributing apparently less than a quantum of heat can be an explanation for the missing heat flux [A Goremykina et al., arXiv preprint arXiv:1908.01213]. This hydrodynamic model relies on the introduction of an artificial high-energy cut-off and lacks a way of a priori obtaining the correct definition of the heat flux. In this work we overcome these limitations and present a formalism, effectively modeling dissipation in the quantum hall edge, proving the quantization of heat flux for all modes. We mapped the QHE to a transmission line by analogy and used the Langevin equations and scattering theory to extract the heat current in the presence of dissipation and (chirality breaking) diffusion.