Highlights

Electronic and thermal transport from the nanoscale to the macroscale – 2018

Nonmonotonic response and light-cone freezing in fermionic systems under quantum quenches from gapless to gapped or partially gapped states

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The properties of prototypical examples of one-dimensional fermionic systems undergoing a sudden quantum quench from a gapless to a gapped state are analyzed, both in integrable and non-integrable models. We observe an anomalous, nonmonotonic response of steady-state correlation functions as a function of the strength of the mechanism opening the gap. In order to interpret this result, we calculate the full dynamical evolution of these correlation functions, which shows a freezing of the propagation of the quench information for large quenches. In noninteracting models, this freezing can be traced back to a Klein-Gordon equation in the presence of a source term.

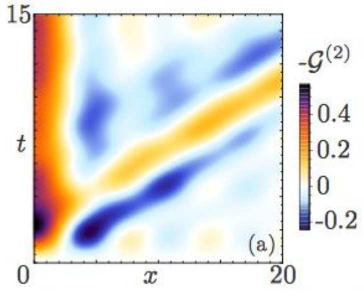

Fig. 1: Quenching a small homogeneous magnetic field in a spin-orbit coupled quantum wire produces a perturbation in the magnetic correlation functions, which travels as a light cone through the system propagating the information.

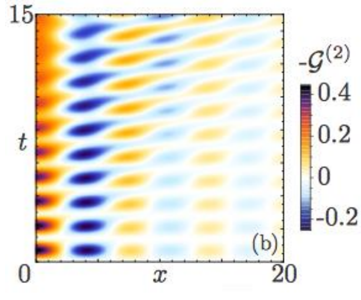

Fig. 2: When a strong magnetic field is quenched, however, the light cone propagation is effectively "frozen". Information cannot travel in an efficient way and, as a result, the wire magnetization is reduced.