Transport Properties as a Tool to Study Universal Quench-induced Dynamics in 1D Systems

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The study of the relaxation process that follows a quantum quench in 1D systems still represents an open research field. Here we consider a sudden change of the interparticle interaction and we identify a peculiar correlator of the system whose behavior is directly and deeply affected by the quench-induced dynamics. Interestingly, it features a universal power-law decay in time. Unfortunately, such a universal decay, although present, turns out to be subleading in intrinsic properties of the system such as the non-equilibrium spectral function. We thus consider a tunnel coupling of the system with a biased tip in order to be able to study also transport properties, namely the charge and energy current flowing from the tip to the system after the quench. In these quantities the universal power-law emerges clearly, especially if one focuses on energy current and its fractionalization into a right- and left- moving components. In particular, we show that the presence of a transient in the energy fractionalization ratio is a direct hallmark of the quench-induced relaxation. Within the setup we have considered, time-dependent transport properties are thus promoted to useful and promising tools to access the mechanisms at the base of the out-of-equilibrium dynamics following quantum quench.