Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Diffusion and ballistic transport in one-dimensional quantum systems JESKO SIRKER, TU Kaiserslautern, RODRIGO PEREIRA, KITP Santa Barbara, IAN AFFLECK, University of British Columbia — It has been conjectured that transport in integrable one-dimensional (1D) systems is necessarily ballistic. The large diffusive response seen experimentally in nearly ideal realizations of the $S = 1/2$ 1D Heisenberg model is therefore puzzling and has not been explained so far. Here, we show that, contrary to common belief, diffusion is universally present in interacting 1D systems subject to a periodic lattice potential. We present a parameter-free formula for the spin-lattice relaxation rate which is in excellent agreement with experiment. Furthermore, we calculate the current decay directly in the thermodynamic limit using a time-dependent density matrix renormalization group algorithm and show that an anomalously large time scale exists even at high temperatures.

J. Sirker, R.G. Pereira, I. Affleck, PRL (2009, in print)

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Date submitted: 04 Nov 2009 Electronic form version 1.4