Abstract submitted to the
NATO ADVANCED RESEARCH WORKSHOP
New materials for thermoelectric applications: theory and experiment
September 19 - 25, 2011 Hvar, Croatia

Transport in disordered systems of interacting fermions

P. Prelovšek[1], O. S. Barišić[2], X. Zotos[3], A. Metavitsiadis[3]
[1] *Faculty of Mathematics and Physics, and J. Stefan Institute, Ljubljana*
[2] *Institute of Physics, Zagreb*
[3] *Department of Physics, University of Crete and FORTH-Hellas, Heraklion*
Submitted : 11-09-2011
Keywords : correlated systems, disordered systems, transport properties

Interplay of disorder and correlations is at present one of challenging theoretical issues. While single-particle states of noninteracting fermions in one dimension are always localized, the influence of interactions are still controversial. First we study the effect of a single static impurity on the many-body states and on the spin and thermal transport in the 1D anisotropic Heisenberg chain at $T > 0$. Whereas the pure Heisenberg model reveals Poisson level statistics and dissipationless transport due to integrability, we show using the numerical approach that a single impurity induces Wigner-Dyson level statistics and at high enough temperature incoherent transport within the chain. Next, dynamical conductivity in a disordered 1D model of interacting fermions is studied numerically at high temperatures and in the weak-interaction regime in order to find a signature of many-body localization and vanishing d.c. transport coefficients. On the contrary, we find in the regime of moderately strong local disorder that the d.c. conductivity σ_0 scales linearly with the interaction strength questioning the possibility of a many-body metal-insulator transition at $T > 0$. Finally, evidence is shown that in a Mott insulator the disorder can even enhance d.c. transport.

[1] O. S. Barišić, P. Prelovšek, A. Metavitisadis, and X. Zotos, Phys. Rev. B **80**, 125118 (2009).
[2] O. S. Barišić and P. Prelovšek Phys. Rev. B **82**, 161106(R) (2010).