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Nonlinear Current Response of an Isolated System of Interacting Fermions

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Nonlinear real-time response of interacting particles is studied on the example of a one-dimensional tight-binding model of spinless fermions driven by electric field. Using equations of motion and numerical methods we show that for nonintegrable (metallic or insulating) systems at high temperatures the major effect of nonlinearity can be accounted by internal heating [1, 2]. On the other hand, integrable metals show on constant driving a different universality with a damped oscillating current whereby the frequency is related but not equal to the Bloch oscillations [1]. Finally, for integrable insulators we obtain strongly nonlinear dc response (see Figure 1) with vanishingly small dc conductivity in the linear-response regime [2]. The latter finding is consistent with equilibrium results for dc limit of the optical conductivity determined in the presence of a weak and decreasing perturbation.

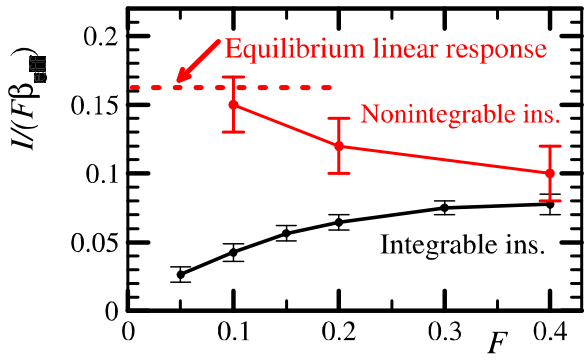

Figure 1: dc response of integrable and nonintegrable insulators at high temperatures: F is the electric field, β_{eff} is an effective inverse temperature and I is dc current induced by F.

[1] M. Mierzejewski and P. Prelovšek Phys. Rev. Lett. **105**, 186405 (2010).
[2] M. Mierzejewski, J. Bonča, and P. Prelovšek arXiv:1106.0604, (accepted for Phys. Rev. Lett.)