Poster 18

Dynamical conductivity in disordered quantum chains

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We study the spectra of dynamical conductivity for interacting fermionic chains with disorder [1]. The dynamical conductivity is calculated numerically by using the Chebyshev matrix product state (CheMPS) method. As a benchmark, we first investigate the noninteracting case and compare the numerics with a known analytical expression, which shows a good agreement. We then calculate the dynamical conductivity spectra of the interacting system with random chemical potential. The spectra shows a power law decay in the high-frequency regime and the power depends on the strength of interaction, which is consistent with the prediction from the bosonized field theory. We also evaluate the characteristic pinning frequency, which is characterized as a peak in the spectra and confirm that it is related to the inverse of the localization length. It is shown that the localization length behaves in a power law of the disorder strength with an exponent that depends on the interaction. In the low-frequency regime, we find that the dynamical conductivity is described by a function $\omega^2(\ln \omega)^2$ independently of the interaction strength. We also discuss the relevance of our finding to the experiments in cold atomic gases.

[1] Shintaro Takayoshi and Thierry Giamarchi, *Dynamical conductivity of disordered quantum chains*, Eur. Phys. J. D **76**, 213 (2022).