Investigation of Luttinger liquids with DMRG and TEBD methods

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I will discuss two numerical approaches based on matrix-product states which can be used to investigate the dynamical properties of quasi-one-dimensional strongly correlated quantum many-body systems. Both methods are illustrated with studies of the spectral functions and transport properties of lattice models in a Luttinger liquid phase. The first approach is based on the dynamical density-matrix renormalization group (DMRG) method [1] and allows us to compute frequency- and momentum-resolved spectral functions. systems [2, 3] as well as the Drude weight [4]. I will present a method for determining the properties of infinite systems from the DDMRG data calculated for large but finite systems. The second approach is based on the time-evolving block decimation (TEBD) method and allows us to compute the time evolution of a system out of equilibrium. I will show that steady-state transport properties (e.g. the conductance of Luttinger liquid quantum wires) can be determined from TEBD simulations of finite-size chains.

References

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