Finite temperature spectral functions using the time-dependent DMRG (New Development of Numerical Simulations in Low-Dimensional Quantum Systems: From Density Matrix Renormalization Group to Tensor Network Formulations)

Feiguin, Adrian E.

物性研究 (2011), 95(6): 603-603

Issue Date: 2011-03-05

URL: http://hdl.handle.net/2433/169465

Type: Departmental Bulletin Paper

Textversion: publisher

Kyoto University
Finite temperature spectral functions using the time-dependent DMRG

Adrian E. Feiguin

1 Department of Physics and Astronomy, University of Wyoming

Exotic quantum many-body behavior such as spin-charge separation is unavoidable when electrons (or other quantum particles with an internal “spin” degree of freedom) are confined to one spatial dimension. While the basic theoretical understanding of spin-charge separation in one-dimension, known as “Luttinger liquid theory”, has existed for some time, recently a previously unidentified regime of strongly interacting one-dimensional systems at finite temperature came to light: The “spin-incoherent Luttinger liquid”. The key to establishing both Luttinger liquid behavior and spin-incoherent Luttinger liquid behavior in experiment is detailed knowledge of the spectral properties.

I will introduce a framework based on the thermo-field formalism, that allows one to describe a thermally mixed state as a pure state in an enlarged Hilbert space. In this language a thermal average reduces to a regular quantum mechanical one. I will show that the spin-incoherent state can be described as a generalization of Ogata and Shiba’s factorized wave function in an enlarged Hilbert space. I will study the crossover from the spin-incoherent to the spin-coherent regime by using the time-dependent Density Matrix Renormalization Group method, combining simulations in imaginary time and real time.

Finally, I will discuss the possibility of realizing spin-incoherent behavior in the *ground-state* of model Hamiltonians, such as ladders, and the Kondo lattice.