Low-temperature DMRG Study of Spin-1/2 Zigzag Chain

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We propose a low-temperatures density matrix renormalization group (LT-DMRG) procedure [1] to obtain physical quantities at low-temperatures. The LT-DMRG is the straightforward extension of the original ground state DMRG technique. We employ the state given by a Boltzmann distribution as a target state. Using a regulated polynomial expansion [2], the target state is obtained by a recursive calculation. Both static and dynamical quantities are obtained after a random-sampling and averaging procedure. The present method can be applied to any low-dimensional systems and is suitable for a low-temperature region. We apply this technique to a frustrated spin-1/2 zigzag XY chain [3]. We calculate temperature dependence of dynamical and static correlations of the spin chirality. In a dimer phase, we find an enhancement of static chiral correlation as well as spin correlation with increasing temperature. The enhancement corresponds to the increase in spectral weight inside a gap in the dynamical chiral-correlation function.

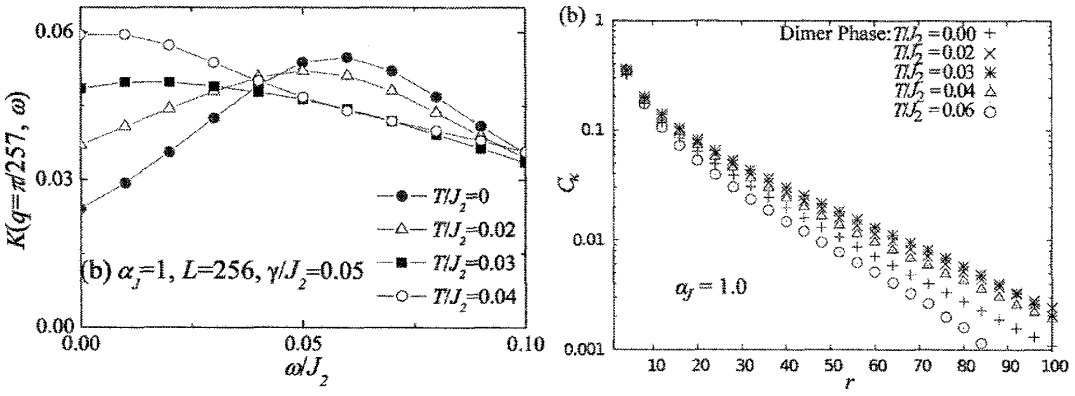

Figure 1: The temperature dependence of the dynamical (left) and the static (right) spin chirality correlation function in the dimer phase ($\alpha_J = J_1/J_2 = 1$).

References

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[3] T. Sugimoto, S. Sota, T. Tohyama, Phys. Rev. B **82**, 035437 (2010).