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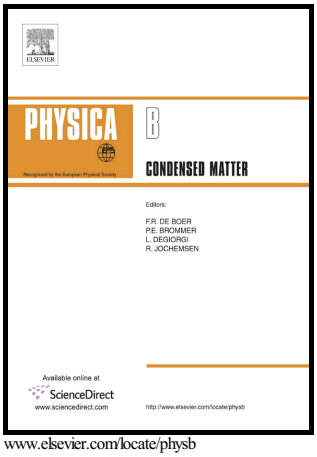

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Various quantum measures and quantum phase transition within one-dimensional anisotropic spin-1/2 Heisenberg *XXZ* model

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Abstract:

In this work, we investigate the dynamical properties of various quantum measures (quantum coherence and correlations) to estimate the system evolution under spin-1/2 Heisenberg *XXZ* model by utilizing quantum renormalization-group method. It has been shown that quantum coherence and correlations can be used to effectively detect a quantum critical point associated with a quantum phase transition (QPT) after several iterations of renormalization. Additionally, we obtain that the dynamical behavior of l_1 norm of coherence is in agreement with that of concurrence and double trace distance discord. Interestingly, Bell-CHSH inequality cannot be violated with increasing of the spin system size *N*. That is, the block-block Bell nonlocality cannot be revealed. Moreover, we reveal some quantitative relations between quantum coherence and some quantum correlations, and thus the l_1 norm of coherence is more conducive for probing the QPT at the critical point within the composite systems. Further, the scaling behaviors and nonanalytic phenomenon of the l_1 norm of coherence and quantum discord are discussed in detail.

Keywords: quantum measures; quantum phase transition; renormalization

1. Introduction

It is well known that quantum entanglement can be dated back to the Einstein's work [1], and has provoked a lot of attention, which in essence lies at the heart of quantum information and quantum computation [2]. Quantum entanglement is a pure quantum correlation without any classical counterpart [3-5], and is regarded as an important resource to dispose and send information in a wide range of fields, such as quantum key distribution [6], quantum cryptograph [7], remote state preparation [8] and quantum teleportation [9, 10]. Besides, quantum coherence