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Low temperature properties of low-dimensional exactly solvable spin models with impurities

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This work is devoted to the theoretical study of quantum stationary states and thermodynamics of some exactly solvable quantum models based on spin-1/2 XX-chain. Low-dimensional spin models occupy special place in quantum theory of magnetism. Some of these systems may have exact analytical solutions. In our study we consider the spin chains with defects: infinite XX-chain with impurity fragment, finite linear XX-chain with an additional ZZ (Ising) bond, two finite XX-chains, connected through an additional ZZ spin, finite spin-1/2 XX-chain closed by one zz (Ising) bond and open ends XX-chain with two zz-impurities at the both ends. For infinitive spin-1/2 XX-chain with impurity fragment in longitudinal magnetic field the exact energy spectrum is found. This spectrum consists of the energy band, set of discrete levels, and may contain from one up to four bound states localized on the boundaries of impurity fragment and main chain. We studied the critical behavior of local static thermodynamic characteristics and time dependence of dynamical longitudinal correlation functions at different temperatures. For finite XX-chain with Ising defects the localized levels near the impurity spin may exist in the spectrum. The conditions for their appearance were found. The field and temperature dependences of some thermodynamic characteristics of the models are studied. It is shown that the localized levels may effect noticeably on local thermodynamic characteristics.

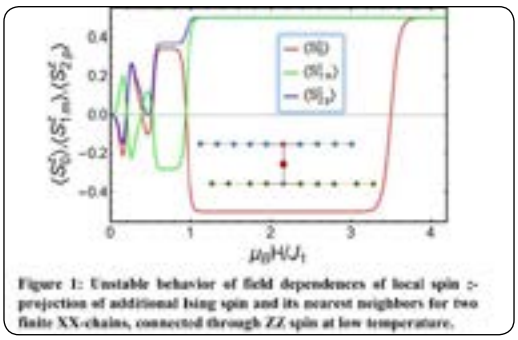

Figure 1: Unstable behavior of field dependences of local spin :- projection of additional Ising spin and its nearest neighbors for two finite XX-chains, connected through ZZ spin at low temperature.

Recent Publications

1. Cheranovskii V O and Ezerskaya E V (2013) U=∞ Hubbard model for 1D frustrated magnets. Croatica Chemica Acta 86:431-434.
2. Cheranovskii V O and Ezerskaya E V (2015) Magnetic properties of the infinite U Hubbard model on one-dimensional frustrated lattices. Journal of Superconductivity and Novel Magnetism 28:773-776.
3. Ezerskaya E V (2017) The energy spectrum and thermodynamics of spin-1/2 XX chain with Ising impurities. Acta Physica Polonica A131:928-930.
4. Cheranovskii V O, Ezerskaya E V, Klein D J and Tokarev V V (2017) Lowest energy states of Hubbard ladder model with infinite electron repulsion. Computational and Theoretical Chemistry 1116:112–116.
5. Cheranovskii V O, Ezerskaya E V, Klein D J and Tokarev V V (2018) Finite size effects in anisotropic u = ∞ Hubbard ladder rings. Journal of Superconductivity and Novel Magnetism 31:1369–1373.

Biography

Elena V Ezerskaya has completed her PhD in the year 1985 from VN Karazin Kharkiv National University. She is Associate Professor at the Theoretical Physics Department of VN Karazin Kharkiv National University. She has published more than 30 papers in reputed journals. She is experienced university teacher and researcher in field of Theoretical Physics for more the 30 years, supervisor of MS and PhD students.

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