QUANTUM ANISOTROPIC XY MODEL ON SPATIALLY ANISOTROPIC SQUARE LATTICE

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9.7 cm

We consider the $s = \frac{1}{2}$ anisotropic XY model on a spatially anisotropic square lattice within the frames of several different approaches: the linear spin-wave theory, 2D Jordan-Wigner fermionization and exact diagonalization completed by finite-size scaling. Our aim is to study the zero temperature behaviour of the long-range order as the exchange interaction anisotropy varies interpolating between isotropic XY model and Ising model and the spatial anisotropy varies interpolating between spatially isotropic square lattice and a collection of noninteracting chains. The 2D Jordan-Wigner fermionization approach similarly to the coupled cluster method and the correlated basis function method detects a quantum phase transition driven by the exchange interaction anisotropy. The conclusions of our study for disappearance of the long-range order as interchain interaction decreases are quite similar to what have been recently found for a plane of interacting spin-$\frac{1}{2}$ isotropic Heisenberg chains. O.D. thanks the STCU for the support (project #1673).

13.4 cm

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