Quantum spin system with single ion anisotropy in a magnetic field

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We present results of the full diagonalisation method applied to the effective spin -1 system with single ion anisotropy. The model considered is the quantum realization of the classical Blume-Capel model. The thermodynamic properties of the system in the presence of a magnetic field are examined taking account a quantum spin ladder with periodic boundary condition, where each rung of the ladder contains two interacting spins -½. The exchange interactions between spins on the rung and also along the main direction of ladder are of antiferromagnetic type. This relatively simple system exhibits very rich thermodynamic behaviour. We present the phase diagram in low temperatures, showing many different types of ordered configurations. The full diagonalisation method gives as very precise information about transitions in the system considered.

The calculations are performed in the unified simulation environment ALPS [1], which offers the *fulldiag* application [2]. Several especially prepared files (using the XML language) determine the system analyzed. We define the geometrical structure of the system graph (the type of vertexes and edges), we determine the type of interactions and construct the hamiltonian of the model. The results of the calculations are processed by *fulldiag-evaluate* procedure, which yields the main thermodynamic characteristics.

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[1] F. Alet *et al.* (ALPS collaboration), J. Phys. Soc. Jpn. Suppl. **74** (2005) 30. (http://alps.comp-phys.org.)
[2] M. Troyer, Lecture Notes in Computer Science, **1732** (1999) 164.

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