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Statistical mechanics and thermodynamics in anisotropic
Heisenberg-like nanoclusters ARMEN KOCHARIAN, Department of Physics
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POGHOSYAN, NERSES ANANIYAN, Yerevan Physics Institute — The single
site quantum and thermal entanglement, concurrences, quantum phase transitions
and quantum critical points are studied in small spin $s = 1/2$ and $1$ in ferromag-
netic and antiferromagnetic Heisenberg clusters. The grand canonical ensemble of
Heisenberg clusters is also used for exact calculations of thermal properties, quantum
and thermal entanglements of the spin lattice models in the presence of magnetic
field and anisotropic field. We study the magnetic phase transitions and crossovers
in clusters of various topologies driven by exchange interaction, external field and
temperature. The comparison with the exact solution for the Heisenberg model in
thermodynamic limit for the limiting cases is also provided. The small Ising and
Heisenberg clusters are also used for comparison with the exact Bethe-ansatz solu-
tions. These exact results in clusters give a novel insight into the properties of single
molecule magnets, the dynamics of magnetization and can be useful for interpreta-
tion of the phase diagram in molecular nanomagnets and nanometer-sized magnetic
particles.

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