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Magnetic properties of six-legs spin-S (S=½, 1) Ising nanotube under the effect of an external field

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Over the last few years, magnetic nanoparticles (nanotubes and nanowires) have attracted the interest of experimental and theoretical researches owing to their quantum importance, surface boundary effects and their promising technological applications such as drug delivery, biomedicine, magnetic resonance (MRI), permanent magnets, long-lasting memories and recording media. In this work, we study a single-walled hexagonal spin-S (S=½ or 1) Ising nanotube on the basis of the effective-field theory (EFT) with correlations and the differential operator technique (DOT). In the six-leg spin nanotube, each spin is connected to its nearest-neighbors through exchange couplings both along the chains ($J_{//}$) and adjacent chains ($J_{\perp}$). Exact expressions for of magnetization, initial susceptibility, critical temperature are obtained as well as the ground phase diagram that is established for different exchange couplings. Some interesting phenomena are revealed, especially for opposite exchange interactions, magnetization plateaus and frustration are found.

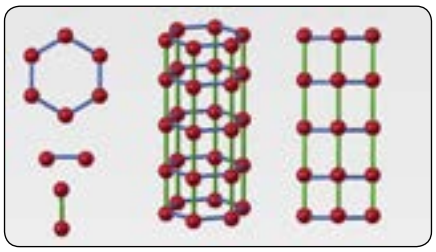

Fig.1: Schematic structure of the hexagonal spin nootube. (a) The red circles display the magnetic specie (S = 1) ions. The green and blue lines correspond respectively to the longitudinal exchange (J//) and transversal exchange ($J_{\perp}$) coupling paths . (b) Equivalent structure of the spin tube with the periodic boundary condition in the direction of rung (under the cyclic constraint α+6=α).

Recent Publications:

1. Z.ElMaddahi A.Farchakh M.Y.El Hafidi and M.El Hafidi. Magnetic and thermodynamic properties of a simple-wall hexagonal spin nanotube. Computational Condensed Matter. Volume 13, December 2017, Pages 77-82
2. Abeslam Farchakh, Mohamed El Hafidi, Contribution to Spin Tubes Study, Journal of Superconductivity and Novel Magnetism, May 2018, Volume 31, Issue 5, pp 1567–1575 in Journal of Superconductivity and Novel Magnetism (2018).

Biography

Mohamed El Hafidi is Professor of Quantum Physics and Magnetism at Hassan University II of Casablanca (Morocco) since 1985. He prepared a part of his PhD at the High Magnetic Field Laboratory (Grenoble, France) and he stayed as a visiting professor as a visiting professor at Joseph Fourier University of Grenoble. He currently supervises research on topological structures and low dimensionality magnetic systems.

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