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Book of Abstracts

Tuesday 04 December 2018 - Wednesday 05 December 2018

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Condensed Matter Physics

Equilibrium states of antiferromagnetic ring-shaped and helix-shaped spin chains with hard-tangential anisotropy

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For the last decade, active research on magnetic nanosystems of curved geometry was motivated by their outstanding properties and great application potential [1]. For instance, recent theoretical studies of low-dimensional magnets with complex geometry propose a description of fascinating geometry-induced effects including pattern formation and magnetochiral effects in quasi-one-dimensional wires [2], for review see [1]. Despite these advances in the study of curvilinear low-dimensional ferromagnets, significant knowledge gaps exist in the study of curvilinear antiferromanetic systems.

The purpose of the current study is the theoretical investigation of equilibrium states in antiferromagnetic ring-shaped and helix-shaped spin chains with hard-tangential anisotropy. For this purpose we use both analytical methods and computer spin-lattice simulations in SLaSi software package [3]. In our study, we consider two sublattice antiferromagnet in the frame of the sigma-model approach where its statics and dynamics are described in terms of Neel vector only.

We analytically show that the global energy minimum of the antiferromagnetic ring-shaped spin chain is reached when Neel vector is perpendicular to the ring plane. An equilibrium phase diagram is constructed for the antiferromagnetic helix-shaped spin chain: (i) a quasi-binormal state is realized in the case of relatively large curvatures and (ii) spatial-periodic state is typical in the opposite case. Both states are described analytically and well confirmed by SLaSi.

Stability regions of both ground states are determined using spin-lattice simulator SLaSi.

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