Skyrmions in chiral and frustrated magnets

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Abstract

Chiral skyrmions exist in non - centrosymmetric magnetic crystals as a consequence of the asymmetric exchange Dzyaloshinskii-Moriya interactions [1]. In my talk I will overview the basic properties of chiral skyrmions. In particular, I will address a long-standing and intriguing problem: why skyrmion states that are totally suppressed in bulk cubic helimagnets arise in broad ranges of magnetic fields and temperatures in free-standing films and epitaxial nanolayers of the same compounds. I demonstrate that chiral surface twists provide a specific mechanism that stabilizes helicoids and skyrmion lattices [2,3]. I also consider the unconventional behavior of 'skyrmion matter' near the ordering temperature which underlies precursor effects experimentally observed in bulk cubic helimagnets with B20 structure [4].

Frustrated skyrmions can be given rise in geometrically frustrated magnets with the triangular lattice due to the interplay of nearest-(J1) and next-nearest neighbor (J2) interactions [5]. "Frustrated" skyrmions have topological charge 1 and 2, arbitrary sign of vorticity and an arbitrary helicity angle. The strong inter-skyrmion attraction gives rise to their clustering in high magnetic fields and topological skyrmion liquids at nonzero temperatures [6]. I will discuss statical and dynamical properties of skyrmions in frustrated magnets which are much richer than those of skyrmions in helimagnets.

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