Chiral magnetic crystals

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Abstract

The weak Dzyaloshinskii-Moriya interaction in chiral cubic magnets like MnSi, FeGe or Cu2OSeO3 twists the magnetization on long length scales resulting in spatially periodic magnetic textures — magnetic crystals. There exist especially magnetic crystals with a one- and two-dimensional periodicity corresponding to the magnetic helix and the topologically non-trivial skyrmion lattice, respectively. In this talk, we provide an overview of their properties. In particular, we discuss the crystallization process of these magnetic crystals that is characterized by strongly correlated chiral paramagnons that drive the transition first-order [1,2]. This fluctuation-induced first-order transition is well described by a theory put forward by Brazovskii. We will introduce the magnon band structure and their non-reciprocal properties in the presence of a magnetic field [3,4]. For the skyrmion lattice, this band structure is topological and characterized by finite Chern numbers that can be attributed to the formation of magnon Landau levels due to an emergent orbital magnetic field [5,6,7]. Finally, we will discuss domain walls of helimagnets that share similarities with grain boundaries consisting of disclination and dislocation defects of the helimagnetic order [8].