

Theory of the helical spin crystal. A candidate for the partially ordered state of MnSi

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We propose that the helical spin crystal (the magnetic analog of a solid) is a useful starting point to understand the partially ordered high-pressure phase in MnSi. We consider helical spin crystals with BCC structure (composed of superpositions of six different helical spin-density waves) and determine conditions under which they may be energetically favored. A Landau theory is introduced to study the properties of these states, in particular the effect of crystal anisotropy, magnetic field and disorder. These results compare favorably with existing data on MnSi from neutron scattering and magnetic susceptibility measurements. Future experiments to test this scenario are also proposed.