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Magnetic Blue Phase in the Chiral Itinerant Magnet MnSi

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In MnSi with the cubic crystal structure B20, the lack of inversion symmetry induces a chiral Dzyaloshinsky-Moriya interaction between magnetic moments. It locally favors helical magnetic order. In addition to a long-range helical order with the well-defined propagation vector, other locally helical phases such as skyrmions and partial order appear in its phase diagram. These enigmatic phases are suspected to be behind many unusual properties of MnSi. I will report results of model calculations, which show that such phases should arise naturally as a result of the basic Dzyaloshinsky-Moriya Hamiltonian. Specifically, in the absence of an applied magnetic field, the free energy in MnSi should be minimized by the magnetic analogue of blue phases, which have previously been observed in chiral liquid crystals. This result is consistent with our recent neutron scattering measurements as well as those of others. The properties of this blue phase explain a number of previously reported puzzling features of MnSi such as partial magnetic order and a two-component specific-heat as well as, possibly, non-Fermi-liquid resistivity at high pressure.