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Skyrmion Lattices in Chiral Magnets

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Skyrmions are topologically stable field configurations with particle-like properties. Using neutron scattering and measurements of the Hall effect we identified the formation of two-dimensional lattices of skyrmion lines, a new form of magnetic order, in metallic and semiconducting B20 compounds, namely MnSi [1,2], $Mn_{1-x}Co_xSi$ [3], $Mn_{1-x}Fe_xSi$ [3] and $Fe_{1-x}Co_xSi$ [4]. The existence of individual skyrmions and skyrmion lattices has recently been confirmed by Lorentz force microscopy for $Fe_{1-x}Co_xSi$ ($x = 0.5$) [5]. The skyrmion lattices in chiral magnets share remarkable similarities with vortex lattices in type II superconductors – they may be understood as vortex lattices of transverse spin supercurrents exhibiting domain formation and complex morphologies. Our studies establish magnetic materials lacking inversion symmetry as an arena for new forms of order composed of topologically stable spin configurations.

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