Small angle neutron scattering studies of the skyrmion lattice in chiral MnSi

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In this presentation we intend to demonstrate that small angle neutron scattering (SANS) is a unique probe of large scale textures in superconductors and magnetic materials. In fact, using SANS we have identified a new form of magnetic order composed of spin vortices, so-called skyrmions, in MnSi [1] and other B20 compounds [2]. A rigorous account of this state shows that it is stabilized by thermal fluctuations. Similar to the vortex lattice of a superconductor, the skyrmion lattice in MnSi can be regarded as a macroscopic lattice, formed by topological entities with particle-like properties, emerging from continuous fields. The topological properties of the skyrmion lattice lead to an additional contribution to the anomalous hall effect caused by the Berry phase [3]. The long range crystalline nature of the skyrmion lattice has been proven by recent high resolution neutron diffraction studies [4].

The identification of the skyrmion lattice sets the stage for the current induced motion of the skyrmion lattice at ultra-low current densities [5], which is akin to the current induced flux lattice motion in superconductors. In this presentation, further emphasis will be laid on future neutron scattering experiments in the time-domain exploiting the time-resolution of the stroboscopic SANS technique TISANE [6] and the neutron resonance spin echo technique MIEZE [7].

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