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Small Angle Neutron Scattering Studies of Skyrmion Lattices

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Skyrmion lattices in chiral magnets can be regarded as macroscopic lattices formed by topological entities with particle like properties where the particle-like character of the Skyrmions is reflected in the integer winding number of their magnetization [1]. Caused by their topology, Skyrmions cannot be destroyed or created by a smooth deformation of a trivial spin texture. Skyrmion lines can be seen as magnetic whirls – sharing strong similarities with vortices of type II superconductors. Analogous to the large variety of different phases of superconducting vortex matter, Skyrmion lattice melting transitions, Skyrmion liquids and Skyrmion glass phases are expected to exist in the various B20 materials. The structure of Skyrmion matter thereby sensitively reflects the underlying physical properties of the material carrying the Skyrmions. Moreover, due to their topology, Skyrmion lattices in chiral magnets provide an excellent showcase for the investigation of topological stability and phase conversion [2]. A further consequence of the special topological properties of Skyrmions is called emergent electrodynamics: While moving through the Skyrmion lattice, conduction electrons collect a Berry´s phase in real space which leads to a very efficient coupling of transport current and magnetic structure. This leads to considerable spin transfer torque effects at current densities as low as 10^6 A/m2 [3]. Small angle neutron scattering (SANS) has played a central role in the investigation of Skyrmion lattices. We show how SANS can be used for a detailed investigation of the structure, stability, transport properties and topological decay of Skyrmion lattices in B20 compounds. *Work in collaboration with: T. Adams, A. Bauer, H. Berger, P. Böni, S. Buhrandt, A. Chacon, S. Dunsiger, L. Eng, K. Everschor-Sitte, M. Garst, R. Georgii, M. Janoschek, F. Jonietz, J. Kindervater, P. Milde, A. Neubauer, C. Pfleiderer, A. Rosch, C. Schütte, J. Seidel, J. Waizner, W. Wünzer

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