Magnetic skyrmion spin texture hosts and detection using small-angle neutron scattering

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Topologically non-trivial magnetic skyrmion spin textures are particle-like entities, characterized by a non-zero topological charge and vortex-like spin arrangements. The first theories predicting magnetic skyrmion formation [1] pointed experimentalists to look to thin films and non-centrosymmetric crystals with chiral interactions, *i.e.* active Dzyaloshinskii-Moriya interactions (DMI). Since the first detection of skyrmions in a crystal meeting those requirements (MnSi) [2], mechanisms besides DMI have been found to stabilize skyrmions and skyrmionic bubbles, such as centrosymmetric materials with uniaxial magnetic anisotropy, *e.g.* Fe_3Sn_2.

This presentation will review structures of known skyrmion spin texture hosts and emphasize the importance of atomic structure when searching for new materials. The direct detection of skyrmions was only first reported about a decade ago using small angle neutron scattering (SANS) [2] and Lorentz transmission electron microscopy (LTEM) [3], allowing skyrmions to be probed in reciprocal and real space, respectively. This rather new ability has hastened and inspired researchers to study the particle-like nature of skyrmions and how they respond to stimuli for manipulation in applications, such as magnetic based memory devices. One material that is currently being studied is the non-centrosymmetric polar structure, GaV_4S_8. One of the only known polar structure skyrmion hosts, GaV_4S_8, exhibits a magnetic field-temperature (*B*-*T*) phase diagram which contrasts that of the well-known cubic chiral magnets due to the polar C_{3v} symmetry. This leads to a comparatively large region of phase space where skyrmions are stable.

This presentation will end by discussing our experimental work on GaV_4S_8 using the SANS technique to study the relaxation dynamics across the *B*-*T* phase diagram. We achieve this by applying both a d. c. and a. c. magnetic field to the system to see how the spin structure responds with varying fields and frequencies. We have found that near the cycloidal-skyrmion phase boundary, we do indeed see frequency dependent changes to the magnetic structure, as have previous reports [4].

References
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