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Diffuse SANS signatures of the DMI

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The antisymmetric Dzyaloshinkii-Moriya interaction (DMI) arises in systems with broken inversion symmetry and strong spin-orbit coupling. In conjunction with the isotropic and symmetric exchange interaction, magnetic anisotropy, the dipolar interaction, and an externally applied magnetic field, the DMI supports and stabilizes the formation of various kinds of complex mesoscale magnetization configurations, such as helices, spin spirals, skyrmions, or hopfions. A question of importance in this context addresses the neutron scattering signature of the DMI, in particular in polycrystalline bulk materials and random nanoparticle assemblies, where the related magnetic neutron scattering signal is diffuse in character and not of the single-crystal diffraction-peak type, as it is e.g. seen for a skyrmion lattice in the B20 compounds. In this talk we discuss (i) the effect of the DMI in spherical FeGe nanoparticles on the randomly averaged magnetic neutron scattering observables, more specifically on the spin-flip small-angle neutron scattering cross section, the related chiral function, and the pair-distance distribution function. Additionally, (ii) recent theoretical results regarding the diffuse scattering signatures of two types of stable hopfions in the SANS observables are presented, and (iii) experimental data for the less well studied microstructural defect-induced DMI are discussed.

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