Keynote–09 –240823

Topological textures in frustrated magnetic materials

O. Zaharko

Laboratory for Neutron Scattering and Imaging, Paul Scherrer Institut, Villigen PSI Switzerland
oksana.zaharko@psi.ch

Keywords: magnetic order, nontrivial topology, frustration

The concept of topology applied to solid state physics and chemistry gives new perspectives for connecting symmetry, electronic structure and physical properties of materials. The discovery of magnetic skyrmions, topologically protected quasiparticle-like swirls of spins, stimulated the vast amount of ongoing work on skyrmion-hosting crystals, the most well-known being: chiral (MnSi, Cu$_2$OSeO$_3$), polar (GaV$_4$S$_8$, VOSe$_2$O$_5$, CeAlGe) and centrosymmetric (Gd$_2$PdSi$_3$, SrFeO$_3$) materials. Theoretical developments have identified the antisymmetric exchange, magnetic anisotropy, mediation by itinerant electrons and geometrical frustration as the dominant factors promoting such topologically nontrivial magnetic states. The progress in the field allows us to understand the stability and emergent properties of these states paving a way for future new technology using skyrmions as magnetic information carriers.

Since a number of excellent reviews are available [1-3], I shall focus on my own perspective of the field and highlight our findings in the spinel MnSc$_2$S$_4$. This system magnetic frustration and magnetic anisotropy give rise to an exotic multi-k fractional antiferromagnetic skyrmion crystal, which we revealed for the first time using neutron scattering experiments and Monte-Carlo modelling [4-6].


I thank all my collaborators for their participation in the presented work. This work was supported by the Swiss National Science Foundation, the Deutsche Forschungsgemeinschaft, CONICET and SECyT.