Contribution ID: **81** Type: **Oral**

Magnetic nano-domain microscopy and topology-sensitive modelling in Fe_3GeTe_2

Friday, 10 October 2025 10:35 (25 minutes)

ABSTRACT

Fe_3GeTe_2 (FGT) is a layered ferromagnetic solid with a Curie temperature of TC ≈ 205K. It is a layered material with out-of-plane magnetic anisotropy. We have performed microscopy investigations of the magnetic nano-domain structures in thin flakes of FGT. The data are acquired using the Fourier Transform Holography (FTH) technique with circular dichroism contrast at the iron L3 edge [1]. These studies complement measurements by scanning x-ray techniques [2], but the extension over a large range of temperatures and applied magnetic fields (B) allows for the creation of specific initial states by cooling from the paramagnetic phase through TC. We observe labyrinthine domains as well as small objects that are identified as Skyrmions. At low temperature, various structures emerge with increasing B field, and the patterns are readily erased by fields exceeding the coercivity. At high temperature, the Skyrmions are denser and re-emerge after reducing the B field.
The experimental study is complemented by modelling calculations based on band structure models with spin-orbit interactions explicitly considered [3]. The corresponding patterns match, and the trends on Skyrmion density in changing B fields are found to be qualitatively different for temperature well below TC and close to TC. This study allows us to conclude on the controllable transformation between these topological states in relation to the temperature dependence of the electronic band structure in FGT.

REFERENCES

1. Eisebitt, S. et al. Lensless imaging of magnetic nanostructures by X-ray spectro-holography. Nature 432, 885–888 (2004).
2. Powalla, L. et al. Seeding and emergence of composite Skyrmions in a van der Waals magnet. Adv. Mater. 35, 2208930 (2023).
3. Kathyat, D. S., Mukherjee, A., & Kumar, S. Microscopic magnetic Hamiltonian for exotic spin textures in metals. Phys. Rev. B 102, 075106 (2020).

Primary authors: HOESCH, Moritz (Deutsches Elektronen-Synchrotron DESY); Dr DASH, Soumyaranjan (Indian Institute of Science Education and Research (IISER), Manauli, India); Dr CHOWDHURY, Sourav (Deutsches Elektronen-Synchrotron DESY)

Presenter: HOESCH, Moritz (Deutsches Elektronen-Synchrotron DESY)

Session Classification: Talks Friday Morning