Contribution ID: **4** Type: **not specified**

Exploring 3D Magnetism through Multi-length Scale Imaging: Unveiling New Frontiers

Thursday, 18 January 2024 15:45 (30 minutes)

Three-dimensional nanomagnetic systems, featuring novel and unconventional spin textures, offer an exciting platform to explore new magnetic phenomena, and also offers possibilities for the development of more efficient, capable and multifunctional technologies. However, harnessing these effects requires an understanding of the fundamental properties and behaviour.
The experimental study of such intricate systems poses a considerable challenge. Until recently, available techniques for probing magnetic materials were confined to flat surfaces or films, rendering the exploration of 3D magnetic systems nearly impossible. As a result, a huge effort has been done in the past few years in the development of state-of-the-art imaging techniques across a range of length scales- from transmission electron microscopy to X-rays- that allows the visualization of the magnetization in three dimensions.
This presentation reviews the developed techniques, showcasing examples that demonstrate how the integration of multiple imaging approaches not only facilitates the study of 3D nanomagnetic systems but also opens avenues for the potential design of complex 3D magnetic devices.

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