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Magnetic Imaging: Studying Magnetic Textures with X-Rays

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In terms of magnetic nanoscale characterization techniques, recent advancements have significantly expanded our ability to probe magnetic materials. Traditionally, available methods were limited to flat surfaces or thin films, making it challenging to explore three-dimensional spin textures. However, in recent years, substantial efforts have been dedicated to developing state-of-the-art imaging techniques across a range of length scales —from transmission electron microscopy to X-ray-based methods—that enable the characterization of more complex spin textures.

By integrating multiple techniques and leveraging in-situ experimental capabilities, It is possible not only to obtain a comprehensive three-dimensional magnetization maps but also established correlations between spin textures and magnetic, chemical, and crystallographic structures. This deeper understanding of the fundamental physics governing complex magnetic systems paves the way for unlocking the potential of nanomagnetic devices.

In this presentation, I will introduce X-ray-based magnetic imaging techniques and provide an overview of various experimental approaches. I will highlight the strengths and limitations of each method, the flexibility of sample environments, and place special emphasis on the techniques available at the ALBA synchrotron.

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