Magnetic singularities topological charge experimentally revealed via soft X-ray tomography

Future perspectives in Spintronics and 3D Nanomagnetism are related to the exploration and comprehension of topologically protected magnetization configurations which can be key for applications as well as bring novel interesting phenomena. However, these topologically non-trivial textures are fully three-dimensional in nature, which requires for their study adequate experimental methods. In this framework, X-ray tomography-based approaches with high lateral resolution and large penetration depth are an excellent choice. Here we have experimentally demonstrated the capabilities of magnetic soft X-ray transmission tomography by reconstructing the complex magnetization of a Ni80Fe20/NdCo5/Ni80Fe20 heterostructure. The system presents weak perpendicular magnetic anisotropy allowing for the formation of stripe domains and supporting magnetic non-trivial topological configurations. After reconstruction, a Bloch point and a Meron-like texture have been identified, and the experimental volumeresolved topological charge map has been computed allowing to get further insight on the formed singularities. The results show the potential of the technique as a unique tool for experimental magnetic 3D characterization of arbitrary systems and heterostructures which could be of great interest for Spintronics, 3D Nanomagnetism and the broader magnetism community.

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