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X-RAY MAGNETIC TOMOGRAPHY: FROM TEXTURES IN THE BULK TO 3D MAGNETIC NANO-STRUCTURES

ABSTRACT

Three dimensional magnetic systems promise significant opportunities for applications, for example providing higher density devices [1] and new functionalities associated with complex topology and greater degrees of freedom [2,3].

With the recent development of three-dimensional imaging techniques, it is now possible to map internal three-dimensional magnetic structures, and their response to external excitations. In this way we have observed three-dimensional vortex structures, as well as Bloch point singularities [4,5] and, more recently, nanoscale magnetic vortex rings [6,7].

In addition to the static magnetic structure, the dynamic response of the 3D magnetic configuration to excitations is key to our understanding of both fundamental physics, and applications. With our recent development of X-ray magnetic laminography [5], it is now possible to determine the magnetisation dynamics of a three-dimensional magnetic system [5].

As well as observing magnetic textures within the „bulk“, recent advances in nanofabrication make possible the fabrication of complex 3D magnetic nanostructures [8]. In this way we have realised magnetic double helices [9], which host highly coupled domain wall pairs that in turn lead to textures in the magnetic induction [9]. These offer not only a potential route to domain wall processing, but also for the patterning of nanotextures in the magnetic field.

These new experimental capabilities for 3D magnetic systems open the door to complex three-dimensional magnetic structures, and their dynamic behaviour.

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NOVEMBER 17, 2021
10:30 AM
ONLINE VIA ZOOM

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