Investigation of three-dimensional magnetic nanostructures for applications in spintronics

A talk by Amalio Fernández–Pacheco

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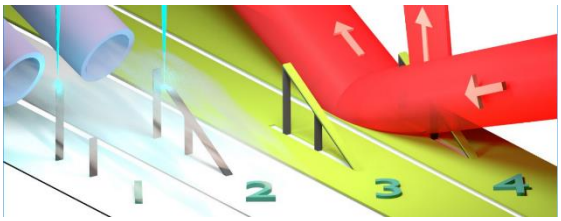
Three-dimensional nanomagnetism is an exciting new area of research [1], with potential applications in fields such as data storage, nanoelectronics and biology. The leap to 3D is becoming possible thanks to novels ways to synthesise and probe magnetic nanostructures. In 3D nanomagnets, new physical effects emerge, with geometry, topology and chirality becoming interlinked.

In this talk, I will show our recent work on 3D magnetic nanostructures for applications in spintronics. We are developing 3D nano-printing methods based on focused electron beams [2]. In particular, we have achieved great control over the growth of 3D magnetic nanowires for domain wall studies [3]. Advanced magnetic microscopy experiments reveal the magnetic state and magnetisation reversal mechanism of the wires, dominated by their geometry and metallic composition [4]. Recent results also show how controllable domain wall motion along the whole space becomes now possible [5]. This has been realised by development of new methods for 3D nano-printing and magneto-optical detection of 3D nanostructures.



During the talk, I will discuss novel methodologies to characterise 3D nanomagnets, including magneto-optical, electron and X-ray microscopy. I will also highlight key challenges and opportunities of 3D nanomagnetism.

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[1] Fernández-Pacheco et al, Nature Comm. 8, 15756 (2017).
[2] De Teresa et al, J. Phys. D: Appl. Phys. 49 243003 (2016).
[3] Pablo-Navarro et al. J. Phys. D: Appl. Physics 50, 18LT01 (2017).
[4] Sanz-Hernández et al, in preparation.
[5] Sanz-Hernández et al, ACS Nano 11, 11066 (2017).