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Zoom

INMA Impulso

Three dimensional magnetic nanostructures: a promising route for future computing technologies

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Magnetic nanostructures are key components of today's society, forming an essential part of computing, sensing and medical technologies. Nanomagnets have led for instance to ultra-high density hard disk drives, a fundamental ingredient of the Internet and the Cloud. However, it is now becoming apparent that to address the fundamental bottlenecks faced by current computing technologies, a paradigm shift is required.

In this talk, I will discuss a promising route to achieving a significant increase in functionality and overcome current fundamental limits, based on moving to complex, hierarchical systems that exploit three-dimensional (3D) geometries[1]. I will first present a new computational framework for the 3D printing of complex-shaped nanostructures using focused electron beam induced deposition [2]. This new development allows us to fabricate3D magnetic nanostructures with unprecedented control. I will then present three examples of 3D magnetic devices that we have recently created and studied: 3D nanowire racetracks, where the controlled motion of magnetic bits along the whole space becomes possible[3]; double-helix nanowire systems where complex chiral magnetic states can be created, for robust data storage and for the motion of magnetic information at low energy[4]; and bridge nanowires to connect circuits in 3D, where anomalous electrical signals are observed, consequence of the magnetic states present in a 3D geometry and their relationship with applied electrical currents[5].

[1] A. Fernández-Pacheco *et al*, *Nature Communications*, 8, 1 (**2017**)

[2] L. Skoric, *Nano Letters*, 20, 184 (**2020**)

[3] D. Sanz-Hernández, *et al*, *ACS Nano*, 11, 11066 (**2017**)

[4] D. Sanz-Hernández, et al, *ACS Nano*, 14, 8084 (**2020**)

[5] F. Meng et al, arXiv:2011.0919

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