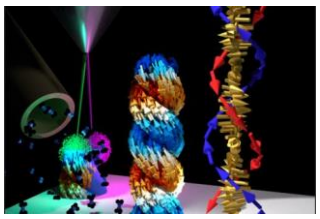

Physics of Three-dimensional nanomaterials

Student projects (Master, Bachelor) currently offered in our group

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Magneto-Optical and magnetotransport effects in 3D nanostructures and heterostructures

Our group is developing new techniques for the advanced study of nanostructures with 3D geometries, as well as metallic heterostructures with complex 3D spin configurations. The student will use advanced optical and electrical techniques to investigate the magnetic response of these systems under complex vector magnetic fields, electrical currents and thermal gradients.

[ACS Nano 1, 11066 (2017); ACS Nano 15, 6765 (2021); Phys. Rev. B 107, 174420 (2023)]

3D nano-printing of magnetic nanostructures with complex geometries

Our group is pioneering the use of focused electrons and ion beams for the 3D printing of complex nanostructures with nanoscale resolution. In this project, the student will learn how to use these techniques and pattern 3D nanomagnets with different geometries. Following their fabrication, a thorough characterisation of the objects via imaging, spectroscopy and optical techniques will be performed, finding the optimum conditions for 3D nano-printing of complex nanodevices.

[Nature Comm. 8, 15756 (2017); Nano Lett. 20, 184 (2020)]]

Fabrication and characterisation of chiral artificial materials

We recently discovered a new type of chiral magnetic interaction in synthetic antiferromagnetic multilayers, which opens a new route for 3D chiral spintronics. In this project, the student will fabricate and characterise multilayered heterostructures, investigating the optimum conditions to enhance interlayer chiral interactions. Spintronic devices will be fabricated and operated under magnetic fields and electrical currents.

[Nature Materials 18, 679 (2019); Appl. Phys. Lett. 123, 172407 (2023)]

Computational studies in 3D nanomagnetism

Complementing our experimental activities, we offer several computational projects for students interested in advanced modelling of magnetic nanostructures, focused on different aspects (topological properties, modelling interactions with light and electrical currents…). Additionally, we offer a project to develop new algorithms for the vector reconstruction of magnetic states using synchrotron datasets, employing machine learning algorithms for image processing and analysis.

[Nature Nanotechnology 17, 136 (2022); ACS Nano 16, 6, 8860–8868 (2022)]

Projects part of
the ERC Consolidator
project 3DNANOMAG