

CONDENSED MATTER SEMINAR

Thursday 12 October at 14:30
Simpkins Lee room

“Engineering Spin Topology in Low-Dimensional Magnets”

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The electric field experienced by a traveling electron translates, in its rest frame, to a magnetic field proportional to its velocity. The Zeeman interaction between the electron spin and this effective magnetic field is equivalent to the coupling of the electron spin and momentum degrees of freedom, known as spin-orbit coupling (SOC). Importantly, SOC effects are greatly enhanced in reduced dimensions: inversion symmetry is broken at a surface or interface, and the resultant electric field couples to the spin of itinerant electrons. In magnetic materials, for example, the states induced by engineering SOC and inversion symmetry-breaking open a broad perspective with an impact on the technology of spin topology [1-3]. Using novel materials platforms that we developed recently [4,5], I will discuss quantifiable insights towards the stability and dynamics of tailored spin textures and demonstrate the viability of spin topology to influence a superconductor at selective length scales for adaptable recipes for fluxonics and chiral superconductivity for Majorana braiding operations. Time permitting, I will also talk about complementary spin configurations that develop quantized helicity excitations [6], offering a new class of building blocks for realizing quantum logic elements.

[1] A. Soumyanarayanan, N. Reyren, A. Fert and C. Panagopoulos, *Nature* 539, 507 (2016).

[2] A. Bogdanov and C. Panagopoulos, *Physics Today* 73(3), 44 (2020).

[3] A. Bogdanov and C. Panagopoulos, *Nature Reviews Physics* 2, 492 (2020).

[4] A. Soumyanarayanan, M. Raju, A. Oyarce, A. Tan, M. Im, A. Petrovic, P. Ho, K. Khoo, M. Tran, C. Gan, F. Ernult and C. Panagopoulos, *Nature Materials* 16, 898 (2017).

[5] A. Petrovic, M. Raju, X. Tee, A. Louat, I. Aprile, R. Menezes, M. Wysznski, K. Duong, M. Reznikov, C. Renner, M. Milosevic and C. Panagopoulos, *Phys. Rev. Lett.* 126, 117205 (2021).

[6] C. Psaroudaki and C. Panagopoulos, *Phys. Rev. Lett.* 127, 067201 (2021).

Host: Prof Paolo Radaelli