II NanoFrontMag Scientific Workshop

Frustrated and topologically protected magnetism in Spin-Ice arrays

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Magnetic frustrated systems known as spin ices have been the focus of intense research in the last years. Due to their non-trivial topology, these systems present a macroscopic degeneracy state in which a wide number of magnetic configurations are equivalent. These configurations create an interesting magnetic landscape potential that, when interacting with superconducting vortices, can completely change their dynamics.

In this work, we have fabricated an artificial Cobalt honeycomb spin ice as shown in figure A. Superconducting vortices will be used to explore the different configurations of the system at the nanoscale. We will show that, depending on the magnetic history of the system, an ordered o disordered magnetic charge distribution can be achieved. When the system is ordered, magnetotransport measurements show the fingerprint of the well-known matching effect (see figure B). Moreover, taking into account the domain wall chirality at the hexagons vertices, a magnetic asymmetry is always present in the sample. We will show that this topologically protected asymmetry will produce ratchet effect, even when the spin ice is a disordered state and there is not matching effect.

Notes and References:

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