

On-line SPICE-SPIN+X Seminars



Wednesday, 14th December 2022, 15:00 (CET)

The seminar will be via Zoom ([Meeting ID: 831 5986 9094](#)) and live streamed in the SPICE YouTube Channel.

Christopher Marrows,
University of Leeds

Skyrmions in chiral magnetic multilayers



Magnetic skyrmions are topologically-nontrivial spin textures with particle-like properties [1]. Their size, topological stability, and mobility suggest their use in future generations of spintronic devices, the prototype of which is the skyrmion racetrack [2]. To realise a racetrack requires three basic operations: the nucleation (writing), propagation (manipulation), and detection (reading) of a skyrmion, all by electrical means. Here we show that all three are experimental feasible at room temperature in Pt/Co/Ir or Pt/CoB/Ir multilayers in which the different heavy metals above and below the magnetic layer break inversion symmetry and induce chirality by means of the Dzyaloshinskii-Moriya interaction, defining the structure of Néel skyrmion spin textures [3]. We show deterministic nucleation on nanosecond timescales using an electrical point contact on top of the multilayer [4] (Figure 1), current-driven propagation along a wire in which the skyrmions are channelled by defects in the multilayer [5], and their detection by means of the Hall effect (Figure 2) that reveals an unexpectedly large contribution to the Hall signal that correlates with the topological winding number [6].

- [1] N. Nagaosa & Y. Tokura, *Nat. Nanotech.* 8, 899 (2013)
- [2] A. Fert et al. *Nature Nanotech.* 8, 152 (2013)
- [3] K. Zeissler et al. *Sci. Rep.* 7, 15125 (2017)
- [4] S. Finizio et al., *Nano Lett.* 19, 7246 (2019)
- [5] K. Zeissler et al., *Nature Comm.* 11, 428 (2020)
- [6] K. Zeissler et al. *Nature Nanotech.* 13, 1161 (2018)