

Séminaire

Vendredi 22 septembre

14 heures

Salle R. Planel du C2N site Marcoussis

Nitin Samarth

“Topological Spintronics: from the Haldane phase to spin devices”

Résumé:

We provide a perspective on the recent emergence of “topological spintronics,” which relies on helical Dirac electrons on the surfaces of solids with strong spin-orbit coupling [1]. When time-reversal symmetry is broken by ferromagnetic order, the helical Dirac states transition to chiral edge states [2]. This is a realization of Haldane’s Chern insulator phase of matter, characterized by a precisely quantized Hall conductance and ballistic edge transport without a magnetic field, even in systems with significant electronic and magnetic disorder [3,4]. The interplay between these edge states, dissipative channels and magnetic order appears to yield a condensed matter realization of quantum tunneling out of a ‘false vacuum’ [4]. Interesting opportunities are also emerging for patterning and manipulating the edge states using optical techniques [5]. On a more pragmatic note, the helical spin texture of the surface states also leads to efficient spin-charge conversion at room temperature [6,7], allowing one to envision novel devices for universal memory and spin-based logic.

[1] M. Neupane, A. Richardella *et al.*, *Nature Communications* **5**, 3841 (2014). [2] A. Kandala, A. Richardella, *et al.*, *Nature Communications* **6**, 7434 (2015). [3] E. Lachman *et al.*, *Science Advances* **1**, e1500740 (2015). [4] M. Liu *et al.*, *Science Advances* **2**, e1600167 (2016).

[5] A. L. Yeats *et al.* *PNAS* (online 12 September, 2017). [6] A. Mellnik, J. S. Lee, A. Richardella *et al.*, *Nature* **511**, 449 (2014). [7] H. Wang *et al.*, *Physical Review Letters* **117**, 076601 (2016).