Master 2: *International Centre for Fundamental Physics*

INTERNSHIP PROPOSAL

(One page maximum)

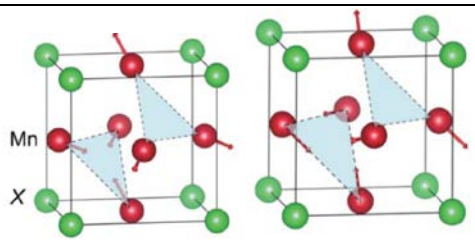
Laboratory name: LPS Orsay
CNRS identification code: UMR 8502
Internship director'surname: Marc Gabay
e-mail: marc.gabay@u-psud.fr Phone number: 01 69 15 69 26
Web page: https://www.equipes.lps.u-psud.fr/gabay/index_f.html
Internship location: LPS Orsay

Thesis possibility after internship: YES
Funding: NO

Interplay of Topology and electronic interactions in functional materials.

Digitally connected is us! This revolution was made possible thanks to huge advances in Materials Science. First, it was realised that electronic interactions promote a variety of competing phases that can be harnessed in order to tweak the state of a system to our advantage. Then came topological concepts. Topological insulators and superconductors as well as Weyl and Dirac semimetals are characterised by global properties; the latter are encoded via the so-called Berry curvature in the form of the associated wave functions. While a classification of topological electronic systems has been successfully achieved in situations when electron-electron interactions can be neglected, much less is known for correlated materials. The proposed project is at the forefront of this new condensed-matter physics challenge, namely unraveling the topological properties of correlated electron systems.

The proposed internship will be a first step in this direction. We will theoretically study a "ready to solve" problem, namely an antiferromagnetic Mn-based compound that consists of stacked layers. To begin with, we plan to describe the band structure of a single layer within a tight-binding model that accounts for the underlying magnetic order within a mean-field description. We will then determine the Berry curvature (a signature of topology), as it impacts the transverse electrical current (Hall) and the thermo-electric transport. The experimental counterpart of this theoretical approach is being actively pursued at ESPCI-Paris



Condensed Matter Physics: YES Macroscopic Physics and complexity: NO
Quantum Physics: YES Theoretical Physics: YES