LNCMI-Grenoble

Anomalous Quantum Oscillations in a topological semimetal ?

M2 (fundamental experimental condensed matter physics)

Summary *(400 caractères maxi)*

During this internship we plan to investigate by thermoelectric measurements (Seebeck and Nernst effects) the temperature dependence of quantum oscillations in a topological semimetal of the RX (R=rare earth metal, X=pnictogen) family and to compare it with theoretical predictions (standard Lifshitz-Kosevich theory, etc.)

Detailed subject *(1200 caractères maxi dont une figure possible)*

The unusual electronic structure of topological materials like Weyl semimetals (conduction and valence bands touch at distinct isolated points in the Brillouin zone and show linear energy dispersion around these so-called Dirac or Weyl points), can give rise to many exotic phenomena, such as extremely large magnetoresistance, chiral magnetic effects, etc. Here we want to explore the interplay between magnetism, electronic correlations and topology by studying Fermi surfaces of the RX family through their footprint, quantum oscillations, a phenomenon that appears at low temperature when sweeping the magnetic field. They are observable in various physical quantities. It turns out that in this RX family previous electric transport experiments point to a behavior that clearly deviates from what is expected in ordinary metals [1], and we want to check whether this is also true for thermoelectric quantities...

The internship will be realized jointly at the "Pheliqs" quantum materials laboratory of CEA Grenoble [2] and at the Grenoble high magnetic field lab LNCMI/CNRS. This successful collaboration exists already for several years, working recently on strong electronic correlations in materials like heavy fermions and unconventional/ferromagnetic superconductors [3].

Concerning this internship, samples and the experimental setup for thermoelectric measurements at low temperatures and high magnetic fields are already available, so the candidate can become operational and obtain first results quite quickly.

Publications linked to the theme

[1] npj Quantum Materials **4**, 20 (2019)
[2] Commun. Phys. **2,** 83 (2019)
[3] Phys. Rev. Lett. **117**, 206401 (2016)
[4] Nat. Commun. **8**, 15358 (2017)

Background and skills expected : solid state physics, experimental skills, no fear of treating large amount of data (Fourier transform), research and team spirit, motivation to continue as a PhD student (see below)

Supervisors :

Alexandre POURRET alexandre.pourret@cea.fr

Gabriel SEYFARTH gabriel.seyfarth@lncmi.cnrs.fr

Recently, an international collaboration and research project was launched with a group at HongKong University concerning topological materials [4]; in this framework **funding for a 3 year PhD thesis in Grenoble is already available** so the M2 internship can be extended into a PhD thesis