



Master / PhD Thesis Project

General Scope: Chiral superconductivity is probably the most “sought-after” state among topological superconductors, due to prominent signatures on the superconducting properties. The most obvious is the spontaneous time-reversal symmetry breaking in the superconducting state. Yet chirality also implies the existence of zero energy excitations (Majorana modes) at interfaces, along “Fermi arcs” joining nodal excitations on the Fermi surface (red line on Figure 1-a). These zero-energy (Majorana) modes are predicted to give birth notably to thermal edge currents, and to anomalous zero-field thermal Hall effect, however still undetected.

Subject: For this internship, we will perform low temperature thermal Hall effect measurements, starting with a ferromagnetic superconductor, UCoGe, which is spin-triplet and chiral. Experiments will explore both the normal and the superconducting state, before attempting to detect the specific anomalous contributions from the chiral superconducting state.

Environment and collaborations: This internship should be continued as PhD, supported by an ANR project (SCATE) gathering a team at Néel, ESPCI and HZDR Dresden with our team (IMAPEC) at Pheliqs, with an objective of combining on the same set-up these macroscopic measurements together with microscopic imaging of the thermal edge currents. The team at Pheliqs is very active and well recognized in this field of spin-triplet superconductivity, and is supported by strong interactions with the theory group of the laboratory (2 on-going PhD’s on this subject) and tight collaborations with groups in Japan. It also owns a unique facility for growing the required crystals.

Required skills: A strong interest for quantum materials and for challenging experiments and questions in condensed matter physics is required.

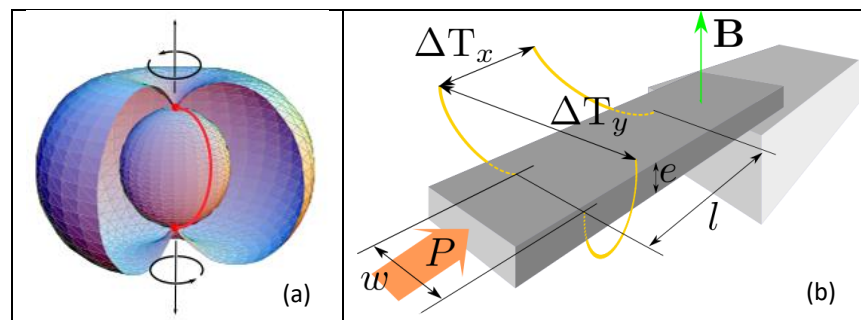


Figure: (a) Nodal chiral excitations in the superconducting state. (b) Scheme of the thermal Hall effect experimental set-up.

APPLY NOW!

To apply for this position, send your application
(including CV) by e-mail to: jean-pascal.brison@cea.fr