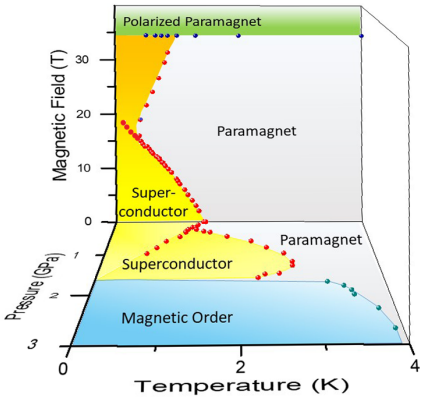
Master / PhD Thesis Project

Superconductivity in systems with local inversion symmetry breaking

General Scope: Global inversion symmetry or time reversal symmetry have been long regarded as fundamental ingredients to form a superconducting state. However nowadays, several systems have been found which are superconducting even though they break locally inversion symmetry, sometimes together with broken time reversal symmetry. Prominent examples are the uranium based ferromagnetic superconductors URhGe and UCoGe (breaking both symmetries), or the new systems UTe_2, and $CeRh_2As_2$, breaking local inversion symmetry. All these systems remain superconducting in very high magnetic fields, often showing even a reinforcement of superconductivity under field. Transitions between spin-triplet and spin-singlet superconducting are suspected in UTe_2 and $CeRh_2As_2$, which are up to now unique in nature.

Subject: In this master project, we want to develop a new high precession ac susceptometer, working at low temperatures in a dilution refrigerator, in order to explore the magnetic properties of superconducting phases of these superconductors. In addition, with the same set-up it will be possible to determine properties of the Fermi surface by the measurements of quantum oscillations of the magnetization. First focus will be on UTe_2, which has a complex superconducting phase diagram as a function magnetic field and pressure, as shown in the figure. Remarkably, multiple superconducting phases occur in UTe_2 and superconductivity survives under magnetic fields up to 35 T for some specific directions. In a following PhD, it will be possible to extend the technique to measurements under high pressure and to look for superconductivity in systems with the same crystal structure as $CeRh_2As_2$.



Environment and collaborations: The candidate will work in a team largely recognized for its contributions to the research on spin triplet superconductors. He will also benefit from strong theoretical support from the theory group of Pheliqs, and have the possibility to interact with groups in Japan where tight collaborations are well established.

Required skills: The candidate should have sound knowledge in solid state physics, good practical skills and interest in the development of instrumentation.

APPLY NOW!

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

French Commission for Atomic Energy and Alternative Energies
Interdisciplinary Research Institute of Grenoble
Quantum Photonics, Electronics and Engineering Laboratory
17 av. des Martyrs – 38054 Grenoble cedex 9 – France