NÉEL INSTITUTE Grenoble

Topic for Master 2 internship – Academic year 2019-2020

Superconductivity at proximity of an electronic instability

General Scope:

Superconductivity is a spectacular macroscopic manifestation of the quantum coherence of electrons. This state is now used for numerous technological issues from green electricity, high magnetic field production to future electronic. However, the mechanism at the origin of the superconductivity still not yet fully understood, especially for systems with strong electronic correlations. In these systems, spectacular high critical temperature, unusual superconducting state are observed. They are often observed at proximity of another electronic ground state, and both phenome are connected. Pressure is an easy way to tune the system and to understand the microscopic mechanism at the origin of the superconductivity.

The main aim of our research is to develop and use new tools under pressure to observed this particular superconductivity.

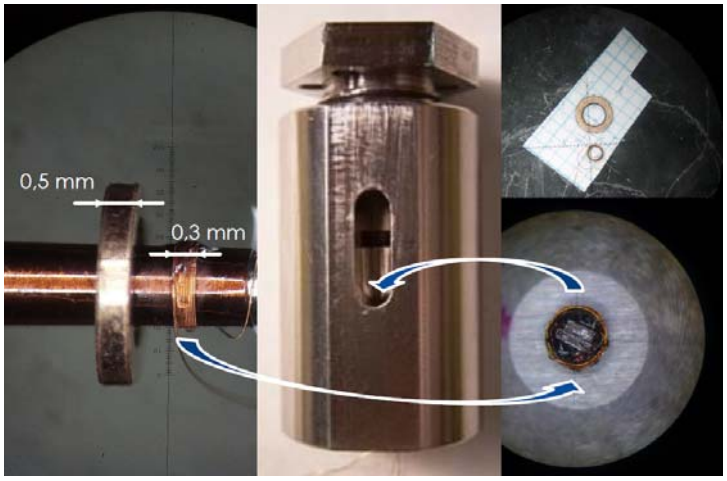

Figure 1 Pressure cell for superconducting condensate measurement

Research topic and facilities available:

We will probe the superconducting properties by measuring simultaneity the magnetic penetration depth λ and the resistivity through a contactless method. The magnetic penetration depth is very fundamental and directly related to the electron density forming the superfluid condensate but also to the superconducting gap. Moreover, the temperature dependence reflects the existence of possible nodes in the superconducting gap, a consequence of broken symmetry induced in the superconducting state. We will compare the results obtained to different models.

Possible collaboration and networking:

We will use an original experimental set-up with world wide performances. We will work at very low temperature very close to the absolute 0K. This work could be performed in strong collaboration with the high pressure lab of the ESRF (G. Garbarino) and/or high magnetic field lab.

Possible extension as a PhD: Yes

Required skills: The candidate will have taste for experimental physic. She/He should have a strong background in solid state physics, electromagnetism and quantum mechanics.

Starting date: 2020

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