Spécialité : PHYSIQUE / Physique de la matière condensée

Laboratoire : /SPEC/GQ

Sonder les fluctuations d'inductance cinétique dans des nano-résonateurs supraconducteurs

Responsable de stage : LE-SUEUR HELENE
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Stage pouvant se prolonger en thèse : Oui
Durée du stage : 4 mois

Résumé:
The Quantronics group at CEA Saclay is performing research in fundamental solid state physics at very low temperature, and in particular in quantum electronics. One present goal of our team is to elucidate the last missing ingredient of mesoscopic superconductivity: the Quantum Phase Slip Junction.

Sujet :
A Quantum phase slip junction (QPSJ) consisting of very thin disordered superconducting wire is predicted to behave as a non-linear nondissipative capacitor, and to constitute an exact quantum dual of the well know and widely used Josephson junction. The availability of QPSJ would open a broad range of new possibilities for quantum circuit engineering.

By making nanowire resonators in order to realize QPSJ, we have evidenced a strong coupling of the resonator to surrounding charged Two Level Systems, an order of magnitude larger than what is expected from standard dipole / electric field coupling. We have shown this phenomenon is present in several superconductors who have in common their high inductance (high disorder). We have proposed recently [1] a new universal mechanism to explain this strong coupling, through mesoscopic fluctuations of the kinetic inductance. The goal is now to characterize further this mechanism.

During the internship, the candidate will be involved in the next experiment that we plan to better understand and characterize the TLS / nanowire coupling. He / she will get familiar with nanofabrication, microwave measurements in dilution refrigerator, and the microwave properties of superconductors. The student will be supervised by two permanent researchers, a PhD student and a post-doc working on the subject. A second post-doc will join us in february 2020. The internship could ideally be followed by a PhD thesis.

The candidate should have solid grounds in quantum and solid state physics and should ideally be familiar with data acquisition and analysis (Python, Mathematica, Origin or Igor?). A certain degree of independence and of experimental skills are a plus.

[1] H. le Sueur et al., Microscopic charged fluctuators as a limit to the coherence of disordered superconductor devices, arXiv:1810.12801

Probing Kinetic Inductance Fluctuations in Superconducting Nanoresonators

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