Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage

Date de la proposition : 25/11/2015

Responsable du stage / *internship supervisor*:

Nom / *name*: GOFFMAN Prénom/ *first name* : Marcelo
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Nom du Laboratoire / *laboratory name*: Quantronics group

Code d'identification : Organisme : CEA, CNRS, Université Paris-Saclay
Site Internet / *web site*: http://iramis.cea.fr/drecam/spec/Pres/Quantro/static/
Adresse / *address:* SPEC (Service de Physique de l'Etat Condensé), CEA Saclay, 91191 Gif-sur-Yvette
Lieu du stage / *internship place*: idem

Titre du stage / *internship title*:
Manipulation of a single spin in a superconductor

Is it possible to manipulate the spin state of a single electron within a superconductor? This is the challenge that we want to address experimentally. Usually, one thinks of a superconductor as an assembly of delocalized and overlapping pairs of electrons, the Cooper pairs. In a series of recent experiments, we have shown that it is possible to localize and detect a single Cooper pair or a single electron using a single-atom constriction in a superconductor [1,2]. We could even manipulate the quantum state of a single Cooper pair using circuit quantum electrodynamics techniques [2]. In the case of a single electron, we envision the manipulation of its spin state if the energy degeneracy of opposite spins is lifted. This could be achieved using a semiconductor sandwiched between superconductors.

The subject requires the student to develop a good understanding of quantum physics, and to learn and master different techniques: nanofabrication, low temperatures, low-noise and microwave measurements. He/she will be integrated in an active research group on quantum electronics.

[1] L. Bretheau et al., "Exciting Andreev pairs in a superconducting atomic contact"
Nature 499, 312 (2013). arXiv:1305.4091
[2] C. Janvier et al., "Coherent manipulation of Andreev states in superconducting atomic contacts"
Science 349, 1199 (2015), arXiv:1509.03961

Quantronics group website

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : yes**

Si oui, financement de thèse envisagé/ *financial support for the PhD*: **CFR (CEA) or EDPIF**

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**