

Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 5/1/2017

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 the quantum state of individual superconducting excitations in nanowires

Can one manipulate the quantum states of individual excitations within a superconductor? We have shown recently that although bulk superconductors consist in an assembly of delocalized and overlapping pairs of electrons, the Cooper pairs, localized states arise at weak links between superconductors [1]. Using atomic-size contacts obtained by a controlled elongation of an aluminum micro-bridge, we demonstrated the quantum manipulation of these fermionic states using circuit quantum electrodynamics techniques [2]. We found that the quantum coherence of the quasiparticles was limited by mechanical instabilities of the atomic contacts.

To circumvent this limitation, we plan to replace the atomic contacts with short semi-conducting nanowires connected to superconductors. This will be the subject of the internship/thesis.

In preliminary experiments on InAs nanowires covered with an epitaxially-grown aluminum shell, we have demonstrated the electrostatic control of the nanowires, and the quality of the contacts to superconductors. New phenomena are expected due to the strong spin-orbit coupling in InAs.

During the internship, the student will be integrated in an active research group on quantum electronics and will acquire several techniques: nanofabrication, low temperatures, low-noise and microwave measurements.

[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: by ANR grant

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