

## Master 2: *International Centre for Fundamental Physics*

### INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Laboratoire de Physique des Solides (LPS)  
CNRS identification code: 8502  
Internship director's surname: MASSEE, Freek  
e-mail: freek.massee@universite-paris-saclay.fr Phone number: 0169153790  
Web page: <https://www.equipes.lps.u-psud.fr/ns2/>  
Internship location: 1 Rue Nicolas Appert, Bâtiment 510, 91405 Orsay, France

Thesis possibility after internship: YES  
Funding already obtained for a PhD: YES If YES, which type of funding: ANR

#### **Atomic scale current noise: the search for Majorana Fermions**

In this internship you will join our scanning probe team to study dynamics and correlations at the atomic scale. In particular, you will use current noise measurements with a scanning tunnelling microscope (STM) to reveal the tunnelling process into individual atoms in superconductors. The main aim will be to distinguish trivial from non-trivial topological states, which is a major experimental challenge. Atomic scale current noise measurements are expected to provide a solution to this problem because the tunnelling characteristics and accompanying noise of a Majorana mode and that of a conventional in-gap state, which can be interpreted as a pair of Majorana modes that are equally coupled to the STM tip, are very different [1].

During the internship, you will first become familiar with the state-of-the-art current noise STM facility at the LPS [2]. After mastering the technical aspects, including the finite frequency circuitry we use for atomic scale noise measurements, you will be directly involved in running the experiment, analyzing the data as it is taken and interpreting the results.

[1] V. Perrin et al., *PRB* **104**, L121406 (2021)

[2] F. Massee et al., *Rev. Sci. Instrum.* **89**, 093708 (2018)

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics:	YES	Soft Matter and Biological Physics:	NO
Quantum Physics:	YES	Theoretical Physics:	NO