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

INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: SPEC
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Internship location: CEA Saclay

Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: Europe

Magic Angle Twisted Trilayer Graphene

Condensed matter physicists used to associate new exotic properties to new materials development. In 2018 a paradigm shift happened with the observation of superconductivity in two layers of graphene with a relative crystallographic rotation of ~ 1.1 degrees, the so-called magic angle twisted graphene (MATG) [1]. This unprecedented new knob to change properties of 2D materials is already showing a plethora of unexplored properties and leading to a universe of new technological applications in the new and fast growing field of twistronics (Twistronics: control of the electronic properties of 2D materials in a van der Waals heterostructure by changing their relative crystallographic alignment)
The unexpected behavior in MATG is due to the existence of flat bands in its electronic band structure. These flat bands are the product of the interplay of interlayer tunneling and angle-induced momentum mismatch, which guarantees a large density of states and therefore an amplification of the effects of interactions. This causes correlated states which manifest experimentally by the emergence of new ground states such as superconductivity (SC), Mott insulators and quantum anomalous Hall effect (QAHE).
Recently, we managed to observe superconductivity in a magic angle twisted trilayer graphene. In this internship, the student will perform electronic transport measurements (current and shot noise) in this device to reveal fundamental properties of cooper pairs.

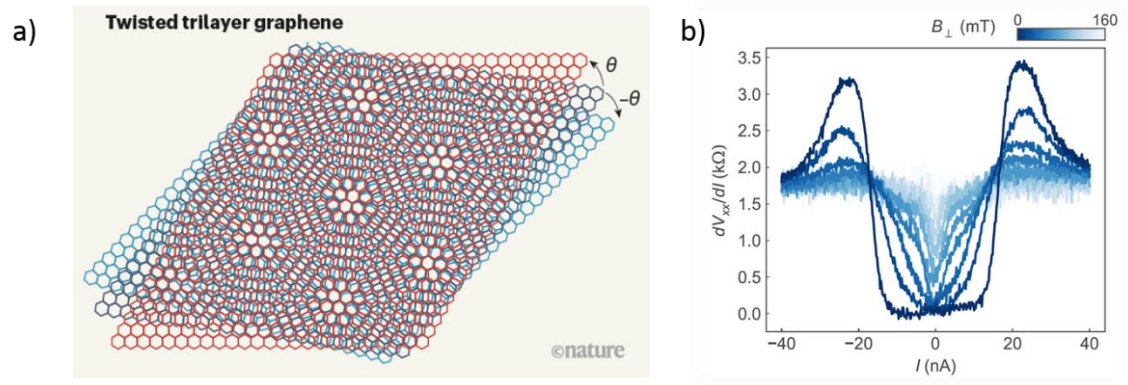

Figure 1:(a) Schematic representation of a twisted trilayer graphene. (b) Fraunhofer pattern of the graphene Josephson junction.

[1] Balents, L., Dean, C. R., Efetov, D. K. & Young, A. F. Nat. Phys. 16, 725–733 (2020).

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