Centre for Nanoscience and Nanotechnology

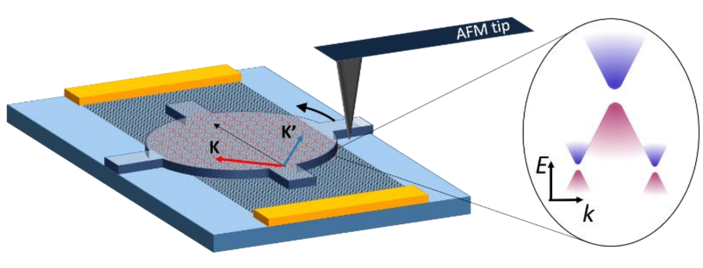
Internship offer:

Probing valley Hall currents in graphene

The first isolation of graphene, one atom thick layer of carbon atoms arrange in hexagons, in 2005 attracted a lot of attention given its remarkable characteristics: high carriers mobility, ambipolar behavior, great mechanical strength. Not long after this, other 2D layered materials were found to have also remarkable characteristics and host a large number of phenomena of condensed matter physics. A great technological achievement of our days is the stack of these 2D layers to form van der Waals (vdW) heterostructures [Nat. Nanotech 5, 722] and therefore combine the properties of each material to design materials with new properties [Nature 499, 419].

Contrary to conventional 2D materials, grown by molecular beam epitaxy, the layered vdW structures can be make of any combination of 2D materials, given that there are not restrictions of lattice parameter. Other degree of freedom of these heterostructures is the relative angular alignment between its layers, which can dramatically alter its fundamental properties. A remarkable example of this, predicted for certain vdW heterostructures, is the emergence of phases of matter where charge carriers flow without dissipation. In heterostructures of graphene crystallographically aligned with boron nitride (insulator isomorph to graphene), such a phase has been predicted. However, due to the scarcity of experimental tools to control the layer alignment the observations available remain inconclusive [Science 346, 448; Science adv. 4, eaaq0194].

In this experimental internship (with possibility to be extended to a PhD thesis), we propose to use a new technique to control the angular alignment between layers in a vdW heterostructure [Science 361, 690] to investigate the generation and control of electrical signals related to this phases of matter in graphene. The successful candidates will participate actively in sample fabrication (assembly of vdW heterostructures, angular control of layers using an AFM, e-beam lithography) and electronic transport measurements at low temperatures. Experience in micro and nano fabrication process is not required since the students will have the necessary training at the lab.



Persons in charge of the internship: Rebeca RIBEIRO-PALAU / Dominique MAILLY
Place: Center for Nanoscience and Nanotechnology (C2N) - Palaiseau
Tel: +33 1 70 27 06 92
e-mail: rebeca.ribeiro@c2n.upsaclay.fr