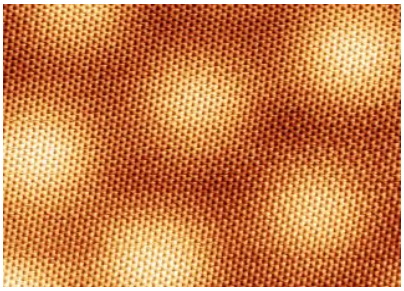
Postdoc Project

Probing the strongly correlated electron physics in the flatbands of graphene-based materials.

Atomically resolved STM image of twisted graphene layers. The short-range period is atomic and the long-range period corresponds to the moiré. Vb=100 mV, it=500 pA



The discovery of graphene [1] was the starting point of a revolution in condensed matter physics. In addition, to being the first 2D materials, it was also the first topological material, a broad family of materials, where topology determines the physics even in the absence of quantizing magnetic field. More recently, composite materials made of two twisted graphene layers launched a new era of strongly correlated electron physics in topological flatbands [2].

Our group has developed a strong expertise in the investigation of electronic properties of graphene monolayers [3,4] and bilayers [5,6] in relation to their structure and topology when electron-electron interactions are low. The present project proposes to apply this expertise to study the strongly correlated electron physics in the flatbands of graphene materials. Using scanning tunneling microscopy and transport measurements, we aim at elucidating how topology and interactions interplay to give rise to the new states of matter (superconductivity, magnetism, insulating behavior etc.) observed in graphene flatbands.

The candidate will be part of a broad collaborating team of experts in sample fabrication, characterization and theory. They will take part in all aspects of the project including mentoring of Phd students and undergraduates. We are looking for a motivated person holding a Phd in condensed matter physics with a strong background in the fabrication of devices based on 2D materials. An experience in millikelvin scanning tunneling microscopy or transport measurements is recommended but we accept candidates with a strong will to learn these techniques.

[1] K. S. Novoselov *et al*. Nature **438**, 197 (2005)
[2] Y. Cao et al. Nature Nature **556**, 43 (2018)
[3] C. Dutreix *et al.* Nature **574**, 219 (2019)
[3] Y. Guan *et al.* Nature Commun. **15**, 2927 (2024)
[5] L. Huder *et al*. Phys. Rev. Lett. **120**, 156405 (2018)
[6] F. Mesple *et al*. Adv. Mater. **35**, 2306312 (2023)

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