Magic **A**ngle **T**wisted **B**ilayer **G**raphene

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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 bilayer graphene (MATBG) [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 MATBG 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) [1], Mott insulators and quantum anomalous Hall effect (QAHE), see Fig. 1A and [3]. In this internship, the student will fabricate such a device and perform electronic transport measurements (current and shot noise) to reveal its fundamental properties.

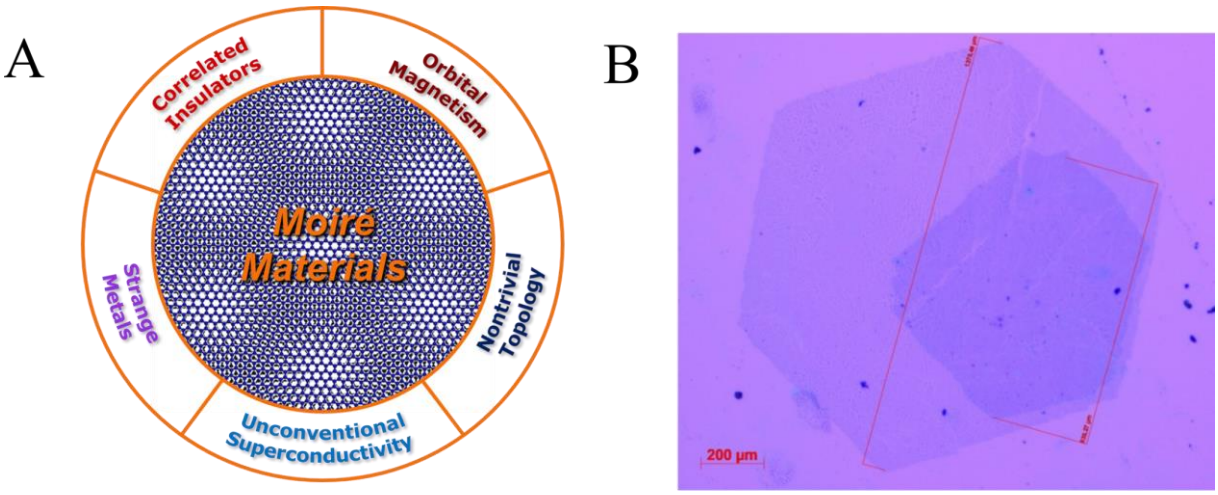

Figure 1(A) Moire materials offer an extremely rich sequence of quantum phases. (B) Preliminary resuls: Optical micrograph of a CVD-based MATBG recently obtained by the one of our partner (University of Louvain) through a new stamp-based transfer technique. Scale bar: 200 µm.

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

[2] Lu, X. et al. Nature 574, 653–657 (2019).

[3] Serlin, M. et al. Science 367, 900 (2020)