# Quasi-periodic signatures in the resistance of doubly aligned BN/graphene/BN

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Abstract

Graphene aligned with boron nitride (BN) forms a moiré pattern due to their lattice mismatch, which manifests in resistance as the well-known satellite Dirac peaks. When a second encapsulating BN layer is also aligned with graphene, the two coexisting moiré patterns create a super-moiré (SM) lattice, whose size and orientation are determined by the commensurate structure of the two original moirés. This SM lattice is also evidenced by smaller peaks in resistance. Here, we experimentally study the density-dependent location of SM peaks in a sample where the bottom BN is fixed, while the top BN can be dynamically rotated. We present electronic transport, magneto-transport and temperature dependence measurements for over 20 different alignments of the top BN within the **same sample**. We then compare the results with predictions from two models: (1) a geometrical model, where each peak corresponds to the filling of a commensurate SM lattice [1]; and (2) a model that predicts peaks at the boundaries of quasi-Brillouin zones, defined by the convergence of different commensurate SM lattices [2]. Our results show that at low densities, the geometrical model provides a sufficient description, whereas at higher densities, the quasi-Brillouin zone framework becomes necessary.

References

[1] Wang et al., Sci. Adv.5 (2019)
[2] Oka et al., PRB 104, 03506 (2021)

Figures

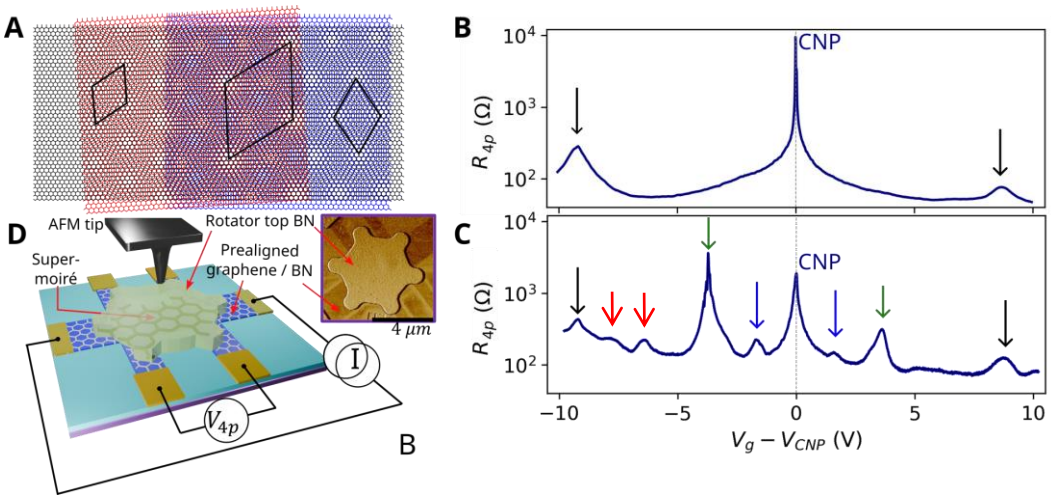


**Figure 1: A:** Schematics of the moiré patterns that are formed between graphene (black lattice) and top BN (red) or bottom BN (blue). In the region where the two moirés coexist, a super-moiré pattern is visible. **B:** 4-probe resistance of the sample. The black arrows show the satellite peaks from the moiré with the bottom BN. Here the top BN is misaligned. **C:** 4-probe resistance of the sample when the top BN is brought to alignment with graphene. The black arrows match the position in figure **B**. The green arrows show the satellite coming from the top BN. The blue arrows show the super-moiré satellite peaks. Other peaks are visible, indicated by the red arrows. **D:** Sketch of the experiment used to control the alignment of the top BN by simultaneously performing electronic transport measurements. AFM image of the rotator on top of the aligned graphene.