

Dynamically rotatable dual-gated heterostructures

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A key problem in the field of twistrionics is control of the relative crystallographic alignment of a heterostructure, as well as reproducibility of this angle in more than one device.

Our recent work^{[1],[2]} showcases a technique that allows for dynamical control of the rotational angle in a single van der Waals heterostructure. However, in a material such as bilayer graphene independent tuning of the carrier density, n , and displacement field, D , is crucial as a perpendicular electric field breaks the system's inversion symmetry.

I will present our recent developments of a new device architecture that allows for manipulation of the relative rotational alignment of a heterostructure while simultaneously controlling both a top and bottom gate. Using this new device architecture, it is possible to probe the basic electronic properties of bilayer graphene aligned with boron nitride at 0° , 30° and 60° - within a single device with independent control of both n and D .

Our measurements reveal an unusual dependence of the energy gap as a function of D at 0° alignment, while 60° alignment and misaligned positions follow previously reported trends^[3].

Furthermore, we unveil key differences in the electronic structure of 0° and 60° aligned positions through low field magnetotransport techniques. I will discuss how we identify the two alignments through the observation of compensated semi-metallic states and transverse magneto focusing signals.

References

- [1] Ribeiro-Palau R. et al, Science 361, 690–693 (2018).
- [2] Arrighi E. et al, Nature Communications, 14, 8178 (2023)
- [3] Icking E., Adv. Electron. Mater., 8, 2200510 (2022)

Figures

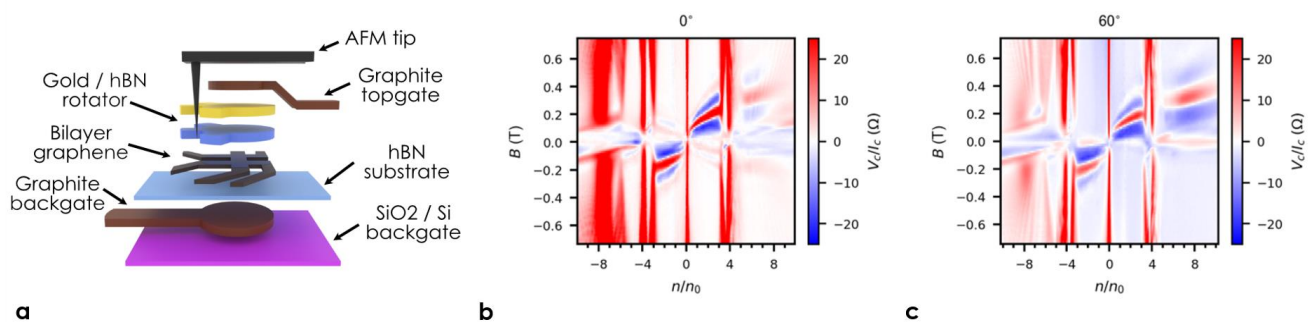


Figure 1. **a** Schematic of the novel device architecture. **b** Measurements of transverse magneto focusing of bilayer graphene aligned with boron nitride at 0° and **c** 60° .