Nano-imaging photoresponse in a moiré unit cell

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Graphene-based moire superlattices have recently emerged as an exceptionally tuneable solid-state system that exhibits rich electronic and optical phenomena. Local probing at length scales of the superlattice should provide deeper insight into the microscopic mechanisms of those phenomena and the exact role of the moiré lattice. Whereas a multitude of different scanning probe experiments have started to uncover the local electrical and optical properties[1] of moiré superlattices, their local opto-electronic properties have so far remained unexplored. In part, this is challenging due to the sub-diffraction scale of the moiré that makes it difficult to resolve superlattice scale features in typical far-field photoresponse experiments. In this talk we will show that near-field photocurrent spectroscopy is a powerful tool for probing the local photoresponse of graphene-based moiré superlattices and present recent measurements on minimally twisted bilayer graphene[2]. Our nano-scale resolution allows us to probe the local photoresponse at length scales of the superlattice period and reveals strong photoresponse caused by domain wall networks that serve as intrinsic photoactive junctions. The measured response exhibits complex spatial patterns governed by the symmetry of the superlattice and a peculiar dependence on the Fermi energy. This work introduces near-field photocurrent spectroscopy as a powerful technique for probing the fine structure and opto-electronic properties of moiré superlattices..

REFERENCES

[1] N. Hesp et al, arXiv:1910.07893 (2019)
[2] N. Hesp et al, Nat Comms 12, Article number: 1640 (2021)

FIGURES

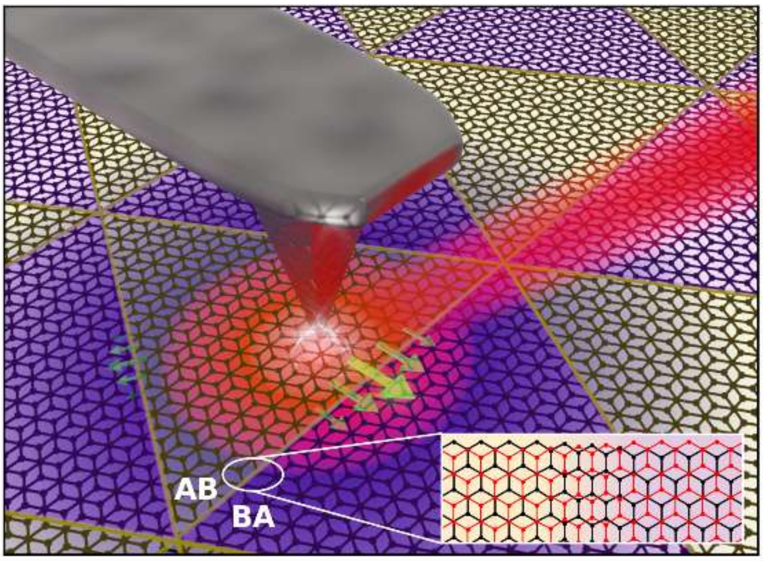

Figure 1: Schematic illustration of nano-photocurrent spectroscopy in minimally twisted bilayer graphene.

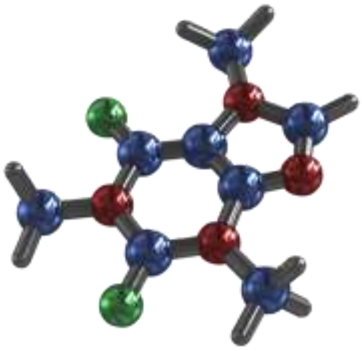

Figure 2: Insert caption to place caption below figure (Arial 10)