Local atomic stacking and symmetry in twisted graphene trilayers

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Moiré superlattices formed from twisting trilayers of graphene are an ideal model for studying electronic correlation, and offer several advantages over bilayer analogues, including more robust and tunable superconductivity and a wide range of twist angles associated with flat band formation. [1,2] Atomic reconstruction, which strongly impacts the electronic structure of twisted graphene structures, [3] has been suggested to play a major role in the relative versatility of superconductivity in trilayers. Despite this, atomic reconstruction has only been probed using indirect measurements or those only applicable to exposed samples. [4] Here, we exploit an inteferometric 4D-STEM approach to image a wide range of trilayer graphene structures. Our results unveil a considerably different model for moiré lattice relaxation in trilayers than that proposed from previous measurements, informing a thorough understanding of how reconstruction modulates the atomic stacking symmetries crucial for establishing superconductivity and other correlated phases in twisted graphene trilayers. [5]

References

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[3] N. P. Kazmierczak et al., Nature materials, 20 (2021) 956–963.
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Figures

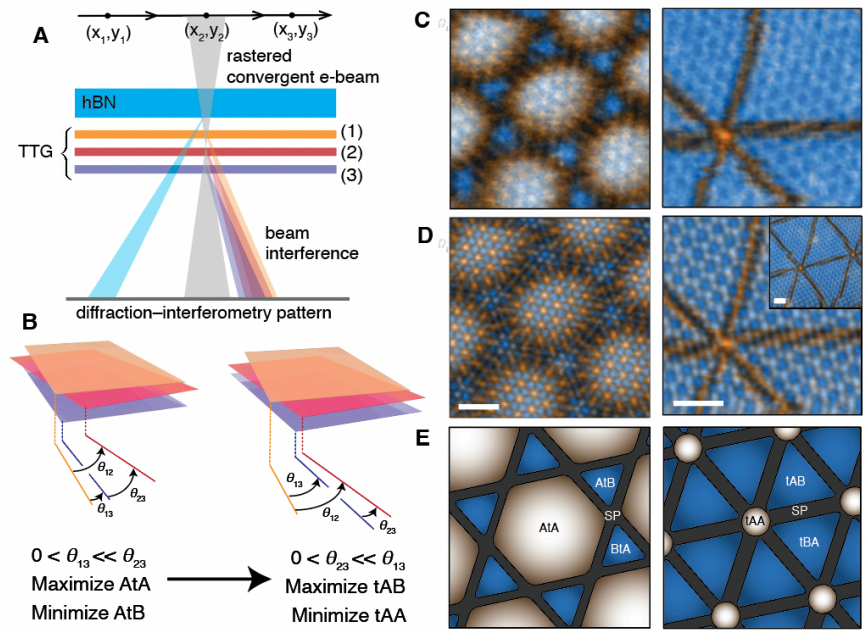

Figure 1: (A) Schematic of the 4D Scanning Transmission Electron Microscopy (STEM) approach, wherein beam interference is used to extract stacking order. (B) Schematics of layer alignment in TTLG. (C) Maps of local atomic stacking from the larger moiré pattern only.(D) Local atomic stacking obtained from considering all three graphene layers. (E) Qualitative schematic illustrating the atomic reconstruction observed.