hBN/Graphene/hBN doubly aligned super-moiré structures

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Van der Waals heterostructures, as vertical stacks assembled by different 2D crystals, have been widely used to produce combinations with predetermined functionalities. Apart from the selection and the sequence of 2D crystals, controlling the twist angle between stacking layers opened the use of another degree of freedom, especially for two crystals with similar lattice mismatch, which forms moire pattern. Unlike the singly aligned heterostructures with one moire pattern, we reported a doubly aligned structure in which fully encapsulated graphene simultaneously aligned to the top and bottom hBNs.[1] In this case, two periodic potentials due to the moire pattern are applied on graphene simultaneously (which can be proved by two secondary Dirac points in transport measurement Fig.1 and two sets of hexagonal patterns in Fourier transformation of AFM image Fig.2) and their differential will create another set of super moires, among which the one with largest period can be independent of the difference in the lattice constants between two crystals and break through the restrictions of this lattice mismatch to achieve the period much larger than 14nm. This would open up the prospect for the design of graphene band reconstruction at arbitrary low Fermi energies.

References

[1] Yankowitz et al., Emergence of superlattice Dirac points in graphene on hexagonal boron nitride. Nat. Phys. **8**, 382-386 (2012).

Figures

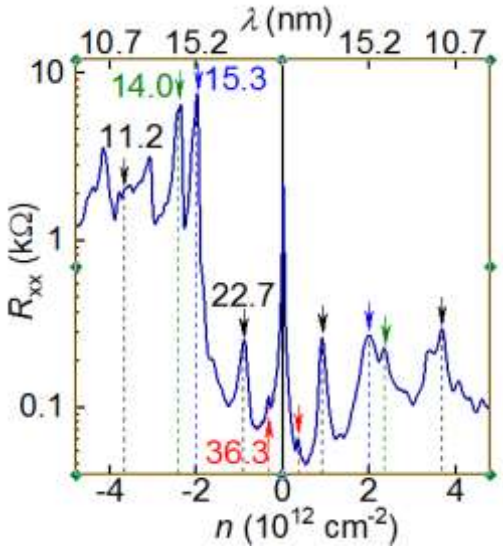

Figure 1: R_{xx} as a function of n with two moire periods 15.3nm (blue), 14.0nm (green). Lattice mismatch is taken as 1.64%. The moiré and super-moiré peaks are marked by arrows and also labelled with their periods in the unit of nanometres. Largest supermoire with the period 36.3nm, marked by red.

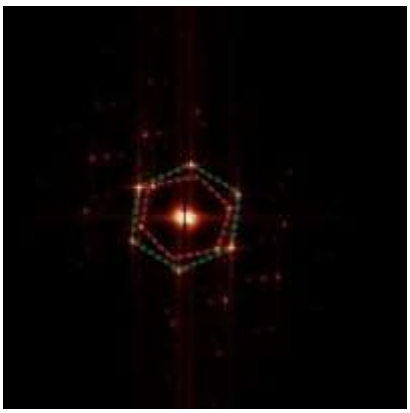

Figure 2: Fourier transformation of the AFM image showing two sets of distinct hexagonal patterns (red and green dashed hexagons).