Commensurate and incommensurate double moire interference in graphene encapsulated by hexagonal boron nitride

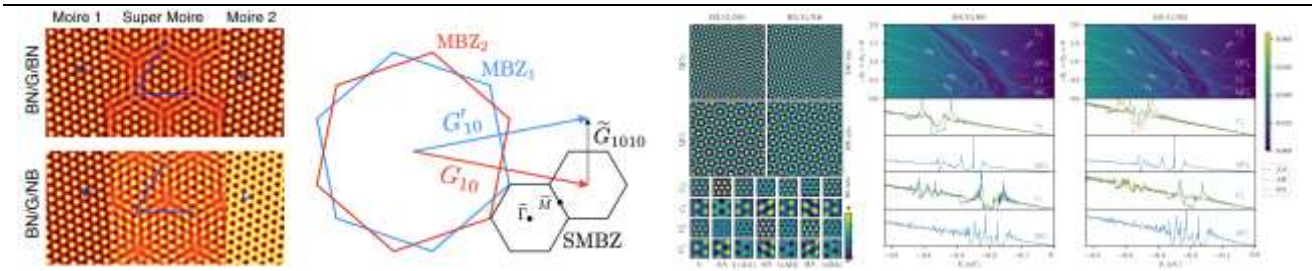
Nicolas Leconte[1]
Pablo Piskunow[2], Stephan Roche[2], Jeil Jung[1]
[1]*University of Seoul, Seoul, South Korea*
[2]*Catalan Institute of Nanoscience and Nanotechnology, Edifici ICN2, Campus UAB, Bellaterra (Barcelona), Spain*
lecontenicolas@gmail.com

Abstract
Interference of double moire patterns of graphene (G) encapsulated by hexagonal boron nitride (BN) can alter the electronic structure features near the primary/secondary Dirac points and the electron-hole symmetry introduced by a single G/BN moire pattern depending on the relative stacking arrangements of the top/bottom BN layers [1]. We show that strong interference effects are found in nearly aligned BN/G/BN and BN/G/NB and obtain the evolution of the associated density of states as a function of moire superlattice twist angles. For equal moire periods and commensurate patterns with ΔΦ=0o modulo 60o angle differences the patterns can add up constructively leading to large pseudogaps of about ~0.5 eV on the hole side or cancel out destructively depending on their relative sliding, e.g. partially recovering electron-hole symmetry. The electronic structure of moire quasicrystals (QCs) for ΔΦ=30o differences reveal double moire features in the density of states with almost isolated van Hove singularities where we can expect strong correlations.

References

[1] N. Leconte, J. Jung, Commensurate and incommensurate double moire interference in graphene encapsulated by hexagonal boron nitride, 2D Materials 7, 031005 (2020)
[2] D Varjas, M. Fruchart, A. R. Akhmerov, P. Perez-Piskunow, arXiv:1905.02212

Figures



Left Figure: Left panel: Superposition of two equal period moire patterns. Right panel: Schematic representation of the two moire Brillouin zones that are rotated with respect to each other and the SM Brillouin zone resulting from their interference. **Right Figure:** *Left panel:* Onsite energy maps for $QC_1^{(\prime)}$, $QC_2^{(\prime)}$, $C_1^{(\prime)}$ and $C_2^{(\prime)}$, for BN/G/BN and BN/G/NB aligned systems, the latter being referenced by primes. *Middle and right panels:* Density of states for combinations of $\theta_1 = -\theta_2$ for BN/G/BN (middle) and BN/G/NB (right) as a function of twist angles. AA, AB and BA relate to relative sliding between moires which shows sensitivity to it in the commensurate regime and insensitivity to it for the QCs.