Double Moire with a Twist: Supermoire in Encapsulated Graphene

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Abstract

Recent advances in the precise manipulation of van der Waals hetereostructures made it possible to align two-dimensional crystals within few degrees. Three recent experiments [cite] on transport properties of encapsulated graphene between two hexagonal boron-nitride (HBN) layers have shown convincingly that besides the well-known moire features appearing in graphene/hBN bilayers, additional angle-dependent lower energy features are robust. We show that when slight misaligned exists between the top and bottom hBN layers, two interfering moire patterns result in a so-called supermoire structure (SM). This leads to lattice (at larger length scale) and electronic spectrum (at low energies) reconstruction. A geometrical construction of the non-relaxed SM patterns allows us to indicate qualitatively the induced changes in the electronic properties and to locate the SM features in the density of states and in the DC conductivity. To emphasize the effect of SM induced lattice relaxation, we report band gaps at all Dirac-like points in the hole doped part of the reconstructed spectrum. These are expected to be further enhanced when interaction effects are included. Our results offer a clear picture on the origin of recently experimentally observed effects in hBN/graphene/hBN trilayers and provide further directions on the tunability of low energy spectrum reconstructions in graphene.

References

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Figures

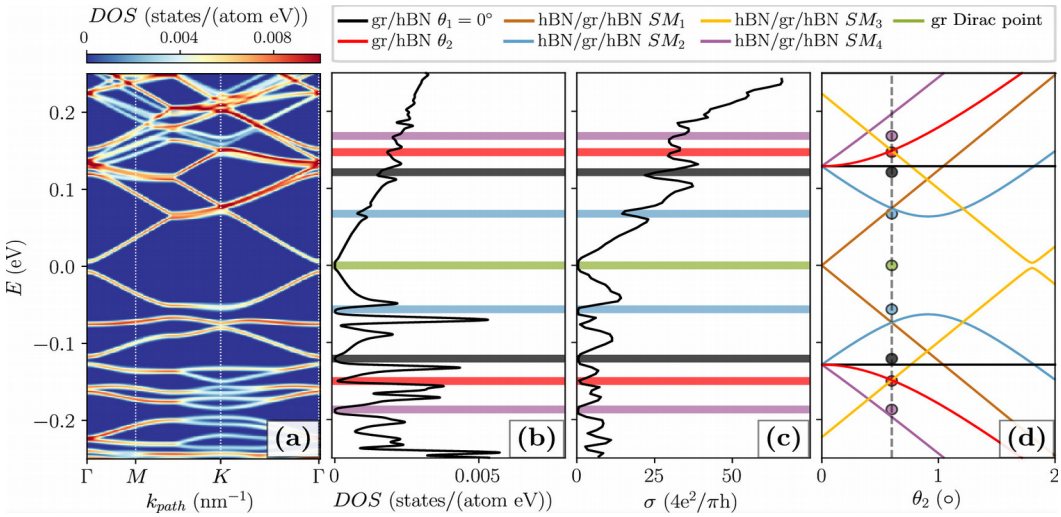

Figure 1: Relaxed supermoire reconstruction of the (a) band structure, (b) density of states, (c) DC conductivity. Panel (d) shows the match of SM features at 0.6 degrees twist to the expected results given by the simple geometric model.