Electronic transport in graphene/*h*-BN moiré-superlattice devices

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Hexagonal boron-nitride (*h*-BN) provides an ideal substrate for supporting graphene devices to achieve fascinating transport properties, such as Klein tunneling, electron optics and other interesting quantum transport phenomena [1-3]. However, the deposition of graphene onto *h*-BN results in moiré superlattices, whose electronic characteristics that can be significantly controlled by managing the lattice alignment between layers [4]. In this talk, we will discuss the effects of these moiré structures on the transport properties of graphene computed using atomistic simulation [5]. In cases of large misalignment angles resulting in smaller moiré cell, the *h*-BN lattice acts simply as a flat substrate and hence the transport properties (most remarkably, Klein tunneling) reported in pristine graphene are still conserved. On the other hand, in the nearly aligned cases, the moiré interaction induces stronger effects, significantly affecting electron transport in graphene. Particularly, there is a significant degradation in Klein tunnelling effect. In contrast, strong Fabry-Pérot interference (accordingly, strong quantum confinement) effects and non-linear I-V characteristics are observed. Furthermore, the engineering of smoothness at the P-N interface is considered as a possible means for improving the transport characteristics in graphene/h-BN devices.

References

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Figures

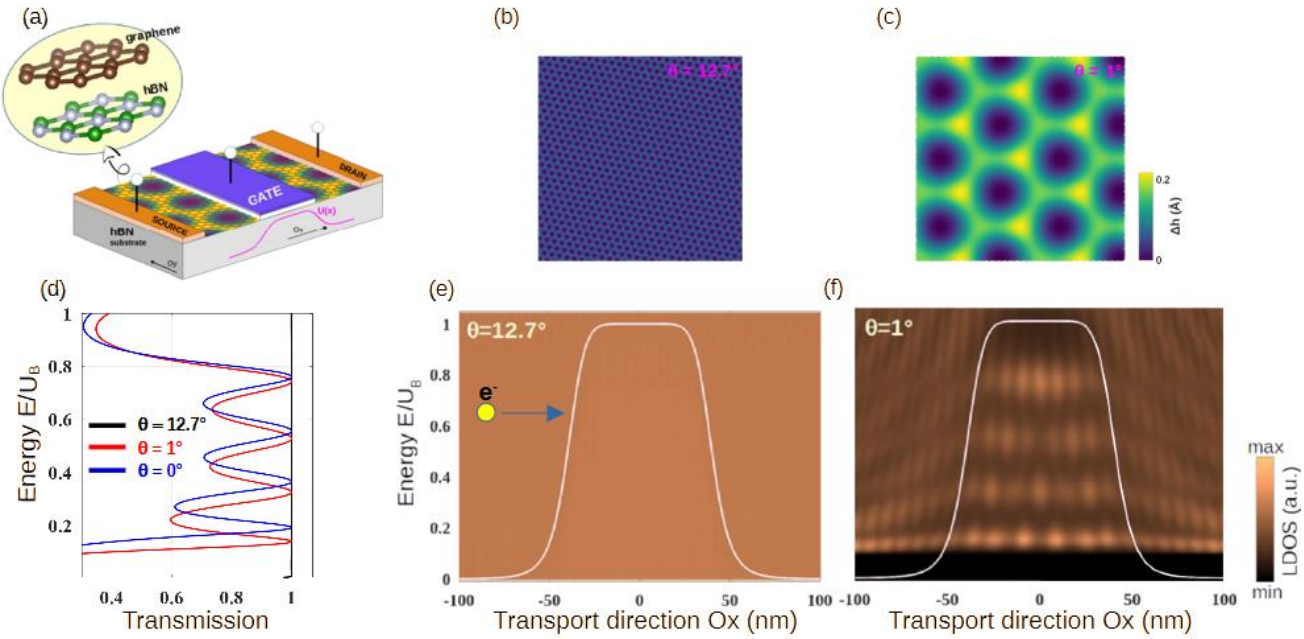

Figure 1: (a) Schematic of graphene on *h*-BN substrate device. (b,c) Moiré superlattices arising in graphene stacked on *h*-BN for large and small misalignment angles θ, respectively. (d) Transmission function through a potential barrier in the graphene/*h*-BN devices in the normal direction for different θ. (e,f) Corresponding local densities of states illustrating the electron propagation through the barrier.