Twisted honeycomb multi-layers – spectrum, transport, and topology

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Abstract:

Graphene, a two-dimensional allotrope of carbon, has drawn much attention since its first experimental isolation. Much of this fascination stems from its exotic low-energy dynamics that is governed by the massless Dirac equation. In this talk I discuss how this dynamics is modified in multilayers of graphene or other planar, honeycomb crystals with an interlayer twist.

First I will discuss scanning tunneling microscopy measurements on twisted graphene multilayers that have revealed a space-dependent splitting of the zeroth Landau level. These experiments have motivated an effective single-layer theory of such multilayers, which can be derived from a microscopically motivated multilayer model. Implications of this theory will be discussed. For example, the theory predicts a spectral gap of graphene on hexagonal Boron-Nitride substrates, another instance of a honeycomb multilayer. I will discuss the physics of this gap formation. In particular, I will highlight some topological properties of this and related models and their consequences for the spectral and transport properties.