Transport properties of twisted bilayer nanoribbons

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The low-energy band structure of bilayer graphene depends strongly on the stacking sequence. While AA stacking preserves the linear dispersion around the Fermi level, typical for a single layer, the AB type stacked graphene has a parabolic dispersion relation [1]. In the case of twisted bilayer graphene, the two layers are rotated an angle smaller than 30°. For small rotation angles, a moiré pattern appears. In this case, we may distinguish regions with both types of stacking, AA and AB, as well as displaced graphene layers, called slip regions. The relative angle between layers determines the electronic properties of the system. It has been shown that for large angles (10° - 30°) with respect to the original AB stacking, the system properties are similar to two non-interacting graphene monolayers. While in the case of small angles, the Fermi velocity decreases, dropping to zero around the angle of 1° [2].
Here we consider the twisted bilayer nanoribbons, which are the stripes of a bilayer graphene with rotated layers. Although there is no controllable way to produce them, twisted bilayer structures appear naturally in some growth methods [3]. Moreover, unzipping multiwall nanotubes could be used to obtain twisted nanoribbons [4].
We investigate the electronic and transport properties of twisted bilayer ribbons. We have performed calculations of conductance and local density of states using the Green function matching technique. The ribbons are described with a tight binding Hamiltonian. We show the dependence of transport properties on the size of the bilayer region. We also investigate the appearance of localized states that appear in these systems.

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