Spatially resolved electronic structure of twisted graphene

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Abstract

The electronic structure of a twisted bilayer graphene deviates substantially from a single layer graphene[1]. A twisted bilayer graphene with a twist angle θ has two Dirac cones located at $K(1\pm\sin(\theta/2))$, where K refers to the Dirac point of graphene. The two Dirac cones in twisted graphene give rise to two Van Hove singularities in the density of states[2]. Here we have used scanning tunneling microscopy to resolve the spatial variation of the density of states within the unit cell of the moiré pattern of a twisted graphene layer on a highly oriented pyrolytic graphite substrate. The integrated differential conductivity spectrums show the presence of well-defined peaks that are ascribed to the aforementioned Van Hove singularities. The spatial map of the density of states near the Fermi level exhibits a honeycomb structure with a lattice constant $a_0/2\sin(\theta/2)$ that is comprised of two sub-lattices. In order to understand the spatial variation of density of states near the Fermi level it is essential to take a third graphene layer into account. Our experimental data is compared to the spatial variation of the electronic structure as obtained by tight-binding calculations.

References

[1] A. H. Castro Neto *et al.*, Rev. Mod. Phys. **81**, (2009) 109
[2] G. Li *et al.*, Nature Phys. **6**, (2009) 109-113

Figures

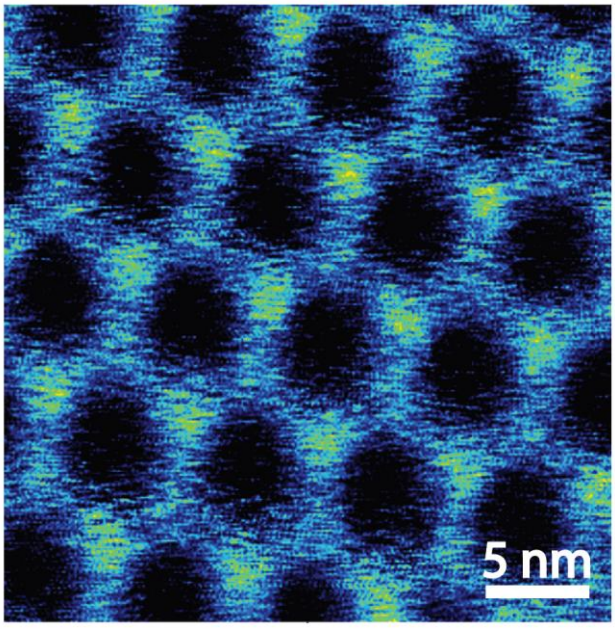

Figure 1: Spatial map of the differential conductivity of the strongest Van Hove singularity.