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Quantum interference in Epitaxial Graphene: Evidence for Chiral Electrons[1]

XIAOSONG WU, School of Physics, Georgia Tech

The extraordinary transport properties of graphene originate from its unique band structure. Electrons in the band have chirality, which correlates the directions of the momentum and the psuedospin. This chirality prevents electrons from being back-scattered, hence causing a particular quantum phase coherent phenomenon, called weak-antilocalization. Recent theoretical work suggested that multilayer epitaxial graphene (EG) grown on SiC possesses essentially same band structure as single layer graphene because of the rotational stacking order between layers. We have investigated the magnetoresistance of EG. We found that weak anti-localization manifests itself as a broad cusp-like depression in the longitudinal resistance for magnetic fields 10 mT B 5 T. An extremely sharp weak-localization resistance peak at $B = 0$ is also observed. These features quantitatively agree with graphene weak-(anti)localization theory implying the chiral electronic character of the samples. Scattering contributions from the trapped char ges in the substrate and from trigonal warping due to the graphite layer on top are tentatively identified. The phase coherence length was found about 1 μm at 4.2 K and the main phase-breaking mechanism was $e - e$ scattering.

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