QUASIPARTICLE CHIRALITY IN EPITAXIAL GRAPHENE PROBED AT THE NANOMETER SCALE

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Many of the tantalizing electronic properties of graphene can be understood as due to the conservation of pseudospin and quasiparticle chirality, two entities that have no equivalence in any other two-dimensional system [1,2]. They are responsible, for example, of the new 'chiral' quantum Hall effects (QHE) observed for monolayer and bilayer exfoliated graphene, which are the most direct evidence for Dirac fermions in graphene [3-5]. Paradoxically, the QHE has not been yet observed in epitaxial graphene [6], which leaves open the question about the Dirac nature of the quasiparticles in this system. Our work shows how pseudospin and quasiparticle chirality can be experimentally detected at the nanoscale by means of STM, since they are reflected in the quasiparticle interference processes that take place in graphene. Our STM data, complemented by theoretical calculations, demonstrate that the quasiparticles in epitaxial graphene on SiC(0001) have the chirality predicted for ideal (free standing) graphene, which proves the Dirac character of the quasiparticles in this system. Moreover, we go one step further and show how the direct observation of pseudospin and quasiparticle chirality can be used to determine the sublattice symmetry of graphene. This a very important issue which has originated an intense scientific dispute, since Zhou et al (2007) [7] proposed the existence of a substrate induced C-C asymmetry in monolayer epitaxial graphene to explain the opening of a bandgap at the Dirac point. We demonstrate that the chirality which we measure on the monolayer discards the existence of such a C-C asymmetry.

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