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Mapping Quantized Cyclotron Orbits of Dirac Particles in Graphene DAVID MILLER, KEVIN KUBISTA, MING RUAN, WALT DE HEER, PHIL FIRST, Georgia Tech, GREGORY RUTTER, JOSEPH STROSCIO, Center for Nanoscale Science and Technology, NIST — Monolayer graphene has unique electronic properties stemming from a low-energy band structure that is linear near the charge neutrality point (Dirac point). In a magnetic field, cyclotron orbits of electrons and holes are quantized into "Landau levels" (LL), with energies E_n that vary proportional to $\sqrt{nB}$, where n is the LL quantum number. The Dirac physics of this system provides an interesting opportunity for experiments in scanning tunneling microscopy (STM) and spectroscopy (STS). We present results from STM/STS measurements of the local density of states (LDOS) of graphene grown epitaxially on SiC (000-1). The sample was studied at 4.3K in ultra-high vacuum under an applied perpendicular magnetic field $\leq$ 8T. Using STS maps, we observed the LDOS over a 100 nm^2 area at energies within $\pm$200meV of the Dirac point. We find transitions from localized to extended states as the LDOS energy progresses across Landau levels. The zero-energy Landau level–unique to graphene–is observed to shift and split in areas where localized states occur. Results from Landau levels of different quantum numbers are also presented for comparison. Work supported in part by NSF, NRI-INDEX, and the W. M. Keck Foundation.

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