Abstract for an Invited Paper
for the MAR07 Meeting of
The American Physical Society

Electronic Confinement and Coherence in Patterned Epitaxial Graphene

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Transport in ultrathin graphite films grown on single-crystal silicon carbide is dominated by the electron-doped epitaxial graphene layer at the interface and shows graphene characteristics. Epitaxial graphene provides a platform for studying the novel electronic properties of this 2D electron gas in a controlled environment. Shubnikov-de Haas oscillations in the magnetoresistance data indicate an anomalous Berry's phase and reveal the Dirac nature of the charge carriers. The system is highly coherent with phase coherence lengths beyond 1 micrometer at cryogenic temperatures, and mobilities exceeding 2.5 square meters per volt-second. In wide structures, evidence is found for weak anti-localization in agreement with recent graphene weak-localization theory. Patterned narrow ribbons show quantum confinement of electrons. Several Hall bar samples reveal anomalous magnetoresistance patterns consisting of large structured non-periodic oscillations that may be due to a periodic superlattice potential.