Abstract Submitted
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Dilute fluorinated graphene and bilayer graphene: resonant impurity scattering, anomalous magneto-transport and local spin-orbit coupling J. ZHU, X. HONG, A. STABILE, C. HERDING, S.-H. CHENG, K. ZOU, B. WANG, J. LI, Penn State University — Graphene is a high-mobility semi-metal with weak spin-orbit coupling (SOC). I will discuss the striking effects of a dilute coverage of chemisorbed fluorine adatoms (F:C $< 0.1\%$) on charge transport and magneto-transport of graphene and bilayer graphene. We show that electron scattering with the F-adatoms can be quantitatively described by resonant impurity scattering. The T-dependence of conductivity reveals strong quantum corrections not yet understood, which differs qualitatively between F-monolayer and F-bilayer. Both F-monolayer and F-bilayer exhibit weak localization in a magnetic field. The dephasing rate τ_ϕ^{-1} is dramatically enhanced in fluorined samples, compared to pristine and defluorinated control samples. It is further tunable by a perpendicular electric field in dual-gated F-bilayer devices. Strikingly, the ratio of τ_ϕ^{-1} over the transport relaxation rate τ_p^{-1} is independent of n_F and scales with the carrier density n as n^{-1} in both F-monolayer and F-bilayer. Strong local SOC induced by the F-adatoms, combined with the unusual effect of SOC on the magneto-resistance of WL, is likely to play a key role. Fluorine induced SOC has important implications on spin relaxation and spin Hall current in these engineered materials.

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