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Experimental studies of conductance fluctuation and tunneling spectroscopy of weakly disordered graphene devices

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We measured the conductance fluctuation and tunneling spectra of single-, bi- and trilayer graphene prepared by mechanical exfoliation. Reproducible fluctuations in conductance as a function of applied gate voltage or magnetic field were found in the electric transport measurements. As the Fermi energy was tuned to near the charge neutral point, the amplitude of the conductance fluctuation was suppressed quickly from a value consistent with universal conductance fluctuations, even though the devices were still well within the weakly disordered regime. The physical origin of the observed suppression may be related to the presence of edge states, or puddles of electrons or holes in graphene devices. The tunneling spectra of planar tunnel junctions of micron size were found to exhibit interesting features that evolve with the backgate voltage, temperature, and applied magnetic field. The implications of these observations will be discussed. This work is done in collaboration with Neal Staley, Conor Puls, and Haohua Wang.