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Raman studies of ultra-clean graphene on hexagonal boron nitride with controlled doping YILEI LI, INANC MERIC, KIN FAI MAK, LEANDRO MALARD, CORY DEAN, PHILIP KIM, KENNETH SHEPARD, TONY HEINZ, Columbia University — Graphene prepared by exfoliation on hexagonal boron nitride (h-BN) provides an ideal platform for studies of the intrinsic properties of Dirac electrons because of its unprecedented charge homogeneity. With this system, many of the fascinating phenomena hidden by charge inhomogeneity in conventional graphene samples have recently been revealed. Here we describe progress in examining both electron-phonon and electron-electron interactions by means of Raman scattering by the G- and the 2D-modes. In our studies, we were able to observe a symmetric energy shift in the Raman 2D peak at low doping levels when the Fermi level was tuned from the electron side to the hole side. This shift is understood as a change in the double-resonance condition induced by the renormalization of the electron and phonon band structures. At the same time, the 2D peak is broadened under electron or hole doping. Additionally, we observed very weak doping dependence of the G peak (both position and width) at Fermi energies less than half of the phonon energy and the subsequent usual removal of non-adiabatic Kohn anomaly with increased doping, which reflects again the extremely homogeneous charge distribution in our samples.

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