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Carrier distribution and negative compressibility in graphene-MoS_2 heterostructures[1] STEFANO LARENTIS, JOHN R. TOLSMA, BABAK FALLAHAZAD, DAVID C. DILLEN, KYOUNG KIM, ALLAN H. MACDONALD, EMANUEL TUTUC, The University of Texas at Austin — We report the investigation of electrical properties and magnetotransport in monolayer graphene - multilayered MoS_2 heterostructures. The devices are fabricated by dry transfer of graphene layers onto exfoliated MoS_2. The conductivity dependence on the back-gate bias shows the ambipolar behavior characteristic of graphene, along with a marked saturation of the conductivity on the electron branch. Magnetotransport measurements reveal that the conductivity saturation is the result of electrons populating the lower mobility MoS_2 layer at a positive, threshold back-gate bias. Experimental data from heterostructures with different thicknesses allow the extraction of the band offset between the MoS_2 conduction band and the graphene charge neutrality point. Surprisingly, the carrier density in graphene reveals a marked decrease as a function of gate bias near the MoS_2 population threshold, an observation which implies that electrons in MoS_2 have negative compressibility at low carrier density.

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