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Tunable Infrared Phonon Anomalies in Trilayer Graphene ZHIQIANG LI, CHUN HUNG LUI, Columbia University, EMMANUELE CAPPELLUTI, Istituto dei Sistemi Complessi, TONY F. HEINZ, Columbia University — Trilayer graphene in both ABA (Bernal) and ABC (rhombohedral) stacking sequences is shown to exhibit intense infrared absorption from in-plane optical phonons. The phonon feature, lying at 1580 cm^{-1}, changes strongly with electrostatic gating. For ABC-stacked graphene trilayers, we observed a large enhancement in phonon absorption amplitude, as well as softening of the phonon mode, as the Fermi level is tuned away from charge neutrality. A similar, but substantially weaker, effect is seen in samples with the more common ABA stacking order. The strong infrared response of the optical phonons and the pronounced variation with electrostatic gating and stacking order reflect the interactions of the phonons and electronic excitations in the two systems. The key experimental findings can be reproduced within a simplified charged-phonon model that considers the influence of charging through Pauli blocking of the electronic transitions.

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