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Isotope impurity doping in graphene JOAQUIN RODRIGUEZ-NIEVA, MIT, RIICHIRO SAITO, Tohoku University, Japan, MILDRED S. DRESSELHAUS, MIT — Isotope impurities provide a powerful technique to study phonon related properties of graphene. The advantage of this approach is that phonon frequencies or thermal properties can be modified so that we can identify the origin of the interaction in the unknown optical spectra without changing either the electrical or chemical properties. In the presence of a ^{13}C isotope impurity in a normally ^{12}C lattice, the phonon wavefunction of graphene becomes localized. When we discuss the electron-phonon interaction of graphene, we treat phonons in terms of a delocalized wavefunction. However, in real graphene, we know that 2% of the atoms are ^{13}C and thus phonons have a finite lifetime, which results in a natural width in the Raman spectra. Many experimental results were obtained recently related to isotopic doping of graphene and carbon nanotubes and its effect on Raman spectra. In this work, we calculate the localization length of the phonons as well as the power law dependence for this effect. At the same time, we calculate the phonon lifetime of the different phonon modes within first order perturbation theory to elucidate the physical mechanisms behind isotope doping and to provide further insight into the experimental results.

[X] Prefer Oral Session
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