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Phonon mediated tunneling into graphene[1] TIM WEHLING, University of Hamburg, ILYA GRIGORENKO, Los Alamos National Laboratory, ALEXANDER LICHTENSTEIN, University of Hamburg, ALEXANDER BALATSKY, Los Alamos National Laboratory — Recent scanning tunneling spectroscopy experiments [V. W. Brar et al., Appl. Phys. Lett. 91, 122102 (2007); Y. Zhang et al., Nature Phys. 4, 627 (2008)] on graphene reported an unexpected gap of about $\pm 60\,\mathrm{meV}$ around the Fermi level. Here, we give a theoretical investigation explaining the experimentally observed spectra and confirming the phonon mediated tunneling as the reason for the gap: We study the real space properties of the wave functions involved in the tunneling process by means of ab-initio theory and present a model for the electron-phonon interaction, which couples the graphene's Dirac electrons with quasi free electron states at the Brillouin zone center. The self-energy associated with this electron-phonon interaction is calculated and its effects on tunneling into graphene are discussed. In particular, good agreement of the tunneling density of states within our model and the experimental $\mathrm{d}I/\mathrm{d}U$ spectra is found.

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