Abstract Submitted
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Mechanism of the doping dependence of 2D Raman band: Dirac-cone migration KEN-ICHI SASAKI, NTT Basic Research Labs, YASUHIRO TOKURA, Tsukuba University, SATORU SUZUKI, TETSUOMI SOGAWA, NTT Basic Research Labs — The Raman G and 2D bands are informative characterization tools. The G band can be used to determine whether or not the position of the Fermi energy μ is close to the Dirac point, since the width broadens when $\mu \simeq 0$, which is known as the Kohn anomaly effect. By contrast, the width of the 2D band sharpens when $\mu \simeq 0$ [1]. We have explored the origin of the difference between the μ dependencies of the G and 2D bands, first intuitively by employing a concept of a shifted Dirac cone, and then more rigorously in terms of self-energy taking electron-phonon coupling into account[2]. By considering a direct transition in shifted Dirac cones, we clarified that the spectral features of a phonon show varieties of behavior that depend strongly on the value of the phonon momentum q. In particular, the resonance decay of a phonon satisfying $v_{\rm F}q > \omega$ (ω is phonon's frequency) into an electron-hole pair is suppressed when $2\mu < \hbar v_{\rm F} q - \hbar\omega$. The idea of shifted Dirac cone can be applied to a general phonon with a nonzero q, including the defect induced D and D$'$ bands, which are of prime importance in recent studies on graphene edges.

[1] Das et al., Nature Nano. (2008).
[2] Sasaki et al., arXiv:1204.4543, PRB (RC) in press.

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