Electron-optical phonon interactions in bilayer graphene

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We have studied electronic conductivity σ and shot noise of bilayer graphene (BLG) sheets at high-bias voltages at $T = 4.2$ K. As a function of bias, we find initially a linear increase of the conductivity, which we attribute to self-heating [1]. At higher bias, the conductivity saturates and even decreases due to backscattering from optical or zone boundary (op) phonons. The electron-op phonon interactions are also responsible of the decay of the Fano factor at $V > 0.1$ V. The high-bias electronic temperature has been calculated from shot noise measurements, and it goes up to 900 K at $V = 1$ V. Using the theoretical temperature dependence of BLG conductivity [2], we extract the electron-op phonon scattering time τ_{e-ph} [3]. In a 230 nm long BLG sample of mobility $\mu_B = 2700$ cm^2.V^{-1}.s^{-1}, we find that τ_{e-ph} decreases as increasing voltage and is close to the charged impurity scattering time $\tau_{imp} \sim 45$ fs at $V = 1$ V.

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[2] S. Adam and S. Das Sarma, Phys. Rev. B **77**, 115436 (2008).
[3] A. Fay, R. Danneau, J. K. Viljas, F. Wu, M. Y. Tomi, M. Wiesner, and P. J. Hakonen, in preparation.