Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Hot electron dynamics and Schwinger mechanism in graphene[1]
MENG-CHIEH LING, JÖRG SCHMALIAN, Ames Laboratory and Iowa State University — We investigate the nonlinear dc conductivity of graphene by explicitly solving the Boltzmann equation with relaxation and particle-hole pair production contributions and obtain the non- equilibrium electronic distribution function. First, by considering isotropic elastic electron-phonon scattering, we show that, in the limit of weak external electric field one recovers Ohm's law, while above a threshold field $E = (k_B T)/(ev_F\tau)$ the dc conductivity varies as the inverse of the external electric field. In particular, we obtain an explicit form for the scaling of the conductivity with respect to E/T. We then investigate how this result is affected by the Schwinger mechanism, which leads to particle-hole creation and, consequently, to interband transitions.

[1]Research supported by the U.S. DOE, Office of BES, Materials Science and Engineering Division

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Date submitted: 18 Nov 2010 Electronic form version 1.4