

Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Energy loss spectroscopy of epitaxial and free-standing multilayer graphene OLEKSIY ROSLYAK, GODFREY GUMBS, Department of Physics and Astronomy, Hunter College at the City University of New York, 695 Park Avenue New York, NY 10065, USA, DANHONG HUANG, Air Force Research Laboratory, Space Vehicles Directorate, Kirtland Air Force Base, NM 87117, USA — We present a formalism and numerical results for the energy loss of a charged particle scattered at an arbitrary angle from epitaxially grown multilayer graphene (MLG). It is compared with that of free-standing graphene layers. Specifically, we investigated the effect of the substrate induced energy gap on one of the layers. The gap yields collective plasma oscillations whose characteristics are qualitatively and quantitatively different from those produced by Dirac fermions in gapless graphene. The range of wave numbers for undamped self-sustaining plasmons is increased as the gap is increased, thereby substantially increasing and red-shifting the MLG stopping power for some range of charged particle velocity. We also applied our formalism to interpret several distinct features of experimentally obtained electron energy loss spectroscopy (EELS) data.

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Date submitted: 14 Nov 2011

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