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BOOK OF ABSTRACTS

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Dynamic-Polarization Forces Acting On A Charged Particle Moving Over A Graphene-Sapphire-Graphene Heterostructure

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Abstract. We investigate the stopping and image forces acting on an external charged particle moving parallel to a sandwich-like structure consisting of two graphene sheets separated by a layer of Al_2O_3 (sapphire), as depicted in FIG. 1. The effective dielectric function of the system is obtained using two descriptions of the electronic response of doped graphene: an *ab initio* method based on the time-dependent density functional theory calculations and an analytical expression based on the massless Dirac fermion (MDF) approximation for graphene π bands. It is found that the main discrepancies between the two methods come from the high-energy interband electron transitions, which are included in the *ab initio* method but not in the MDF method. Special attention is paid to the regime of low-particle speeds, where the MDF method compares well with the *ab initio* method, but the modeling is sensitive to the effects of finite temperature and the treatment of phenomenological damping. We also provide a semi-analytical analysis based on a modal decomposition of the energy loss function, for which we discuss the limit of a thick graphene-Al_2O_3-graphene structure.

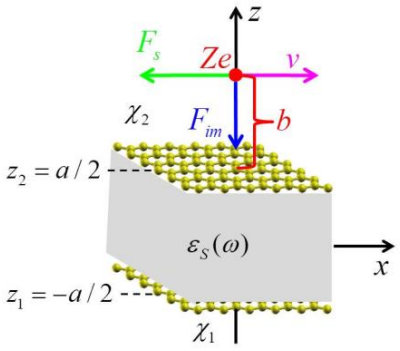

FIGURE 1. Diagram of the stopping force F_s and the image force F_{im} that act on the point charge Ze moving parallel to the x axis with constant speed v at a fixed distance b above the graphene-sapphire-graphene heterostructure. The polarization function of the top graphene layer placed in the $z_2 = a/2$ plane is χ_2 and of the bottom in the $z_1 = -a/2$ plane is χ_1. The Al_2O_3 layer of thickness a is described by local dielectric function $\varepsilon_s(\omega)$.