Effect of Topological Disorder and Spin-Orbit Coupling in the Transport Properties of Graphene

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In this work, we investigate the transport properties of topologically disordered graphene samples. For this aim we compute, using the Kubo methodology and the Lanczos method, the density of states (DOS), mean free paths and classical conductivities of an amorphous graphene sample containing pentagons and heptagons in its atomic structure. We find that the electronic properties change dramatically in the electron side (see Figure) while the hole side remains similar to that of pristine graphene.

We also explore the effect of Rashba and intrinsic spin-orbit coupling (SOC) on the graphene DOS due to the presence of non-magnetic metal adatoms with high atomic number (Z) in the atomic structure of graphene. Depending on the position where they lay on top of graphene, they can enhance the Rashba or the intrinsic SOC affecting in a very different way its electronic properties at the Fermi level. For this purpose we have implemented the Kane-Mele Hamiltonian [PRL 2005] in our Kubo package for transport calculations which has demonstrated to be a very efficient way to introduce spin-orbit effects in graphene.

References

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Figure

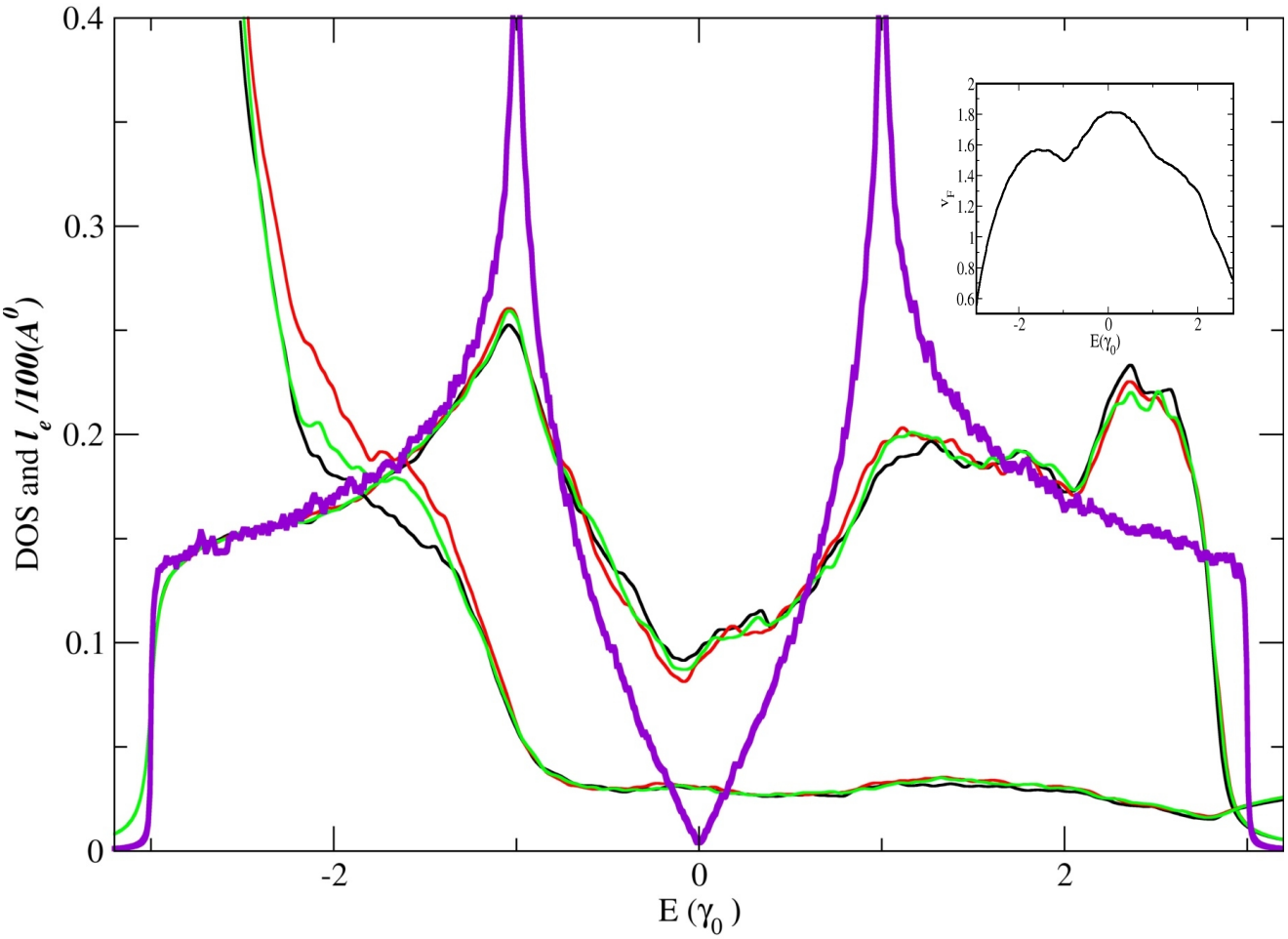

Fig. Density of states for three samples and corresponding mean free paths. Density of state for pristine graphene (violet). Inset is velocity for three samples.