# Transport properties of rippled graphene

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(Dated: 15.04.103)

The interest in graphene, a single plane of carbon atoms forming a honeycomb lattice, is both fundamental and practical. The peculiarity of its electronic structure, consisting near Fermi energy of a massless Dirac fermions, gives rise to the range of novel phenomena like minimal conductivity, Klein paradox, or the anomalous Quantum Hall Effect. At the same time the high mobility of its carriers which number and character can be controlled either by electric or chemical doping makes graphene a potential candidate for application in ultra-fast electronic devices. While it is common to describe graphene as ideally flat plane, there exists both theoretical end experimental evidence that it is most usual to find it in a rippled state. The ripples can be either induced by the substrate or formed spontaneously in suspended graphene. The lateral size of such features ranges between several and tens of nanometers with the height of up to 1 nm. It has been suggested that the presence of ripples could be one of the factors ultimately limiting mobility of carriers and that it may be also responsible for the lack of weak localization observed in certain graphene samples.

The electronic structure of rippled graphene is modified via three mechanisms: *i)* bond length modification, *ii)* $\sigma - \pi$ hybridization and *iii)* strain-related deformation potential. In the effective mass picture the first of these corresponds to a vector potential describing a quasi-magnetic field acting on Dirac fermions. The latter two give rise to a scalar potential of alternating sign which effect is to locally modify the doping.

In the present contribution the effect of rippling on transport properties is studied within either single-band or a „full" $sp^3$ tight-binding model. An effective wave function-matching (WFM) method for conductance calculations allows for treatment of systems with lengths of over 100 *nm* and consisting of $10^5$ and more atoms. Particular attention is given to the problem of minimal conductance (for nominally neutral graphene) and the limits to which its universal value persists in the presence of rippling disorder.