Edge disorder and valley filtering in strained graphene nanostructures

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Valleytronics aims to use the control over the valley degree of freedom, i.e. the index of the minimum of the conduction band in semiconductor, in order to process or store the information. Graphene – and other 2D materials of the same symmetry – with the distinctive valleys (Dirac cones) located at non-equivalent corners of the 2D Brillouin zone and weak inter-valley scattering is well suited to be the base material for valleytronic devices. The necessary condition for realizing these is the creation of the efficient valley-polarizers. One possible way to achieve this is to introduce strain, which enters the effective Dirac-Weyl Hamiltonian as pseudo magnetic gauge field. Importantly the sign of the field depends on the valley index, opening the way to use in order to separate carriers from different valleys. In the present contribution we discuss the results of theoretical calculations of the transport properties of of the strained graphene nanostructures designed to facilitate valley-filtering. The particular focus here is the effect of the edge disorder invariably present in the structures obtained by contemporary lithographic processes.