Schrödinger-Poisson scheme for description of a quantum dot gate defined within bilayer graphene

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In bilayer graphene the external electric field introduces asymmetry between the layers and opens the energy gap [1] in the dispersion relation allowing for electrostatic confinement of the carriers [2]. The idea of electrostatic confinement was recently exploited in a number of experimental setups [3]. We present a numerical simulation of a charging experiment of an electrostatic bilayer graphene quantum dot with model accounting for the finite size of the graphene flake and electrodes setting the confinement potential.

We determine the charge density and the potential profile in the device using the Schrödinger-Poisson scheme. The model accounts for redistribution of the charge density within the device due to the external potentials. Since the potentials applied to the electrodes exceed the range of the linearity of the dispersion relation for which the Dirac continuum approach is applicable we use the tight binding method in the space spanned by p_z orbitals. In the Schrödinger-Poisson (SP) scheme we assume a positive charge at each ion, and the distribution of electrons occupying the p_z orbitals are determined in a self-consistent manner using a DFT approach.

As the self-consistence of the SP scheme is obtained we calculate the chemical potentials of the confined systems and then describe the charge stability diagrams of the quantum dots in function of the applied voltages [3] and external magnetic field. We discuss the stability diagrams and charging properties of the system in external magnetic field.

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