Capacitance of graphene nanoribbons I.V. ZOZOULENKO, J.W. KLOS, A.A. SHYLAU, Linkoping University — We present an analytical theory for the gate electrostatics and the classical and quantum capacitance of graphene nanoribbons (GNRs) and compare it with the exact self-consistent numerical calculations based on the tight-binding p-orbital Hamiltonian within the Hartree approximation [1]. We demonstrate that the analytical theory is in a good qualitative (and in some aspects quantitative) agreement with the exact calculations. There are however some important discrepancies that are traced to the quantum mechanical effects leading to the significant modification of the self-consistent charge distribution in comparison to the noninteracting electron description. The role of electron-electron interaction in the electronic structure and the capacitance of the GNRs is discussed. Finally, we discuss an experimental extraction of the quantum capacitance from experimental data.

[1] A. Shylau, J. W. Klos and I. V. Zozoulenko, Phys. Rev. B, in press (arXiv:0907.1040v1 [cond-mat.mes-hall])

I. V. Zozoulenko
Linkoping University

Date submitted: 28 Oct 2009   Electronic form version 1.4