ELECTROSTATICS OF PHASE BOUNDARIES IN EQUILIBRIUM COULOMB SYSTEMS [[1]](#footnote-1)\*)

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Two fundamental features of any phase interface in equilibrium Coulomb systems are under discussion. It should be stressed that both these features are not valid for phase interfaces in system with any short-range (non-Coulomb) interaction potentials: (*i*) – existing of stationary average electrostatic potential drop between coexisting phases (Galvani potential), and (*ii*) – possibility of localization for macroscopic electric charge on the phase interface in the case when this interface is located in gravitational field of massive astrophysical object (compact star). Theoretical background and historical comments are discussed briefly for the both mentioned effects. Principal non-equivalence of discussed Galvani potential from another fundamental electrophysical characteristics of condensed Coulomb systems – work function – is analyzed and discussed.

Theoretical statements claimed above are illustrated through several typical realization of equilibrium phase interface electrostatic potential drop (Galvani potential). It is e.g. “electrostatic phase diagram” for so-called Wigner crystallization in well-known simplest plasma model – One-Component Plasma on rigid or uniformly compressible background /ОСР(#) and OCP(~)/, with Galvani potential for classical and quantum (“cold”) melting. General structure, as well as low- and high-temperature limits {*Т* → 0 и *Т* → *Т*cr} along coexistence curve are discussed for electrostatic potential of gas-liquid phase interface in metals and alloys, and the same for non-congruent evaporation in chemical compounds like oxides (UO2, SiO2 etc) and ionic liquids and molten salts etc. (Iosilevskiy I., plenary at Zvenigorod conference, 2015). “Electrostatic portrait” for popular version of so-called “Plasma” Phase Transition (PPT) by Saumon, Chabrier & Van Horn (1995) in hydrogen is estimated. Finally, the sign and magnitude for discussed electrostatic potential is illustrated in exotic situation – for the phase interface of hypothetical quark-hadron (deconfinement) phase transition in extremely dense nuclear plasmas in interiors of compact stars (white dwarfs, neutron stars, strange stars etc.)

The second fundamental electrostatic feature of phase interface in equilibrium Coulomb systems in present lecture – principle possibility of localization for macroscopic charge at the phase interface – is discussed for example of idealized model of totally equilibrium compact star without magnetic field and relativistic effects. The localization of macroscopic charge at the phase interface in such situation is direct sequence of interplay of discontinuity in extensive thermodynamic parameters at this interface and plasma polarization in massive self-gravitating bodies due to macroscopic effects of gravitation and Coulomb non-ideality, which was discussed already at previous Zvenigorod conference (Iosilevskiy I., plenary, 2010)

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/R/ru/LM-Iosilevskiy.docx) [↑](#footnote-ref-1)