Electrostatics of Phase Boundaries in Coulomb Systems

Iosilevskiy I.L.[1,2,@] **and Chigvintsev A. Yu.**[2]

[1] Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg˜2, Moscow, 125412, Russia
[2] Moscow Institute of Physics and Technology, Institutskiy Pereulok 9, Dolgoprudny, Moscow Region, 141701, Russia

[@] iosilevskiy@gmail.com

Any interphase boundary in equilibrium Coulomb systems is accompanied by the finite difference at the average electrostatic potentials in both phases - so called "Galvani potential" (GP). It is valid for any type of phase transitions – 1st or 2nd order, isostructural or non-isostructural, enthalpic or entropic, congruent or non-congruent etc [1]. This interface potential drop is a purely thermodynamic quantity in contrast to another well-known electrophysical object – work function. It depends on temperature only and does not depend on non-thermodynamic quantities like surface properties etc. The GP(T) has two remarkable limits: - The zero-temperature limit of this drop (along the coexistence curve) is new remarkable individual thermo-electrophysical coefficient of substance. It supplements the set of known basic individual parameters of real materials such as sublimation energy, ionization potential etc. At high temperature limit GP(T) tends to zero at critical point of any fluid-fluid phase transitions. And additional critical exponent should be defined to describe this behavior.
Study of the GP(T) features became illuminative for all phase transitions in simplified Coulomb models [1]: e.g. for melting and evaporation in One Component Plasma model and in the model of Binary Ionic Mixture on uniformly compressible background - OCP($\sim$) and BIM($\sim$); in the model of Mixture of Hard (or Soft) Charged Spheres etc. The features of GP(T) can be studied at calculation of phase transitions in multicomponent non-ideal plasma of real substances via so called Chemical Model of plasma (e.g. SAHA-code). And last but not least - GP(T) at the boundary of Quark-Hadron Phase Transition (QHPT) in physics of neutron stars!

[1] Iosilevskiy I. Thermodynamics of non-ideal plasmas, in: "Encyclopedia of Low-Temperature Plasma Physics" (Suppl. V.III-1), Eds. A.Starostin and I.Iosilevskiy, Moscow: Fizmatlit, 2004, PP.349-428 (in Russian)