Microions correlations effect on equilibrium spatial charge distributions in asymmetric complex plasmas

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We explore the influence of non-ideality (microions correlations) on anomalies in microions distributions in the macroion field with high charge number ($Z >> 1$) in Coulomb systems including complex plasmas [1]. Taking the microions correlations into account [2] leads to significant difference in microions distributions in comparison with the results [3, 4] of their standard descriptions in the traditionally used Poisson–Boltzmann approximation or its linearization, the Debye–Hückel approximation. This difference becomes not only quantitative, but also qualitative. Thus, taking into account microions correlations can lead to anomalous discontinuities in the discussed distributions [1]. The indicated discontinuities receive a natural physical interpretation as standard phase transitions (condensation, crystallization, etc.) contained in the macroscopic equation of state of one-component microions plasma on a homogeneously compressible background. It leads to a change in the ideal gas equation of state used in describing the local properties of the microions system in the Poisson–Boltzmann (or Debye–Hückel) approximation.

[1] Martynova I and Iosilevskiy I L 2025 *Teplofiz. Vys. Temp.* **63**(Additional issue) 794–801
[2] Martynova I A and Iosilevskiy I L 2021 *Contrib. Plasma Phys* **61**(2) e202000142
[3] Martynova I A, Iosilevskiy I L and Shagayda A A 2017 *Contrib. Plasma Phys* **58**(2-3) 203–208
[4] Iosilevskiy I L, Chigvintsev A Y, Noginova L Y and G Z I 2021 *Teplofiz. Vys. Temp.* **59**(6) 836–843