Anomalous spatial charge profiles of plasma in trap as manifestation of phase transitions in local equation-of-state approximation

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Discontinuities in equilibrium spatial charge profiles of ions in non-uniform Coulomb systems is a common phenomenon in wide number of thermoelectrostatics problems. As we showed in our previous works such discontinuities are peculiar micro-level manifestation of phase transitions and intrinsic macro-level non-ideality elects in local equation of state (EOS), which should be used for description of non-ideal ionic subsystem in frames of local-density (or 'pseudo fluid' or 'jellium' etc) approximation. Special emphasis is made in present paper on the mentioned above non-ideality elects in non-uniform ionic subsystems, such as equilibrium charge profile in ionic traps with different 'external potentials'. Multiphase EOS for simplified ionic model of classical charged hard spheres on uniformly compressible electrostatic compensating background was constructed and several illustrative examples of discussed discontinuous ionic profiles were calculated.