Theoretical approach to the ground state of spherically confined Yukawa plasmas

CHRISTIAN HENNING, MICHAEL BONITZ, ITAP, University of Kiel, ALEXANDER PIEL, IEAP, University of Kiel, PATRICK LUDWIG, HENNING BAUMGARTNER, ITAP, University of Kiel — Recently spherical 3D dust crystals (aka Yukawa balls) were discovered [1], which allow direct observation of strong correlation phenomena and the structure of which is well explained by computer simulations of charged Yukawa interacting particles within an external parabolic confinement [2]. Here we present an analytical approach to the ground state of these systems using the minimization of the system’s energy. Applying the non-local mean-field approximation we show that screening has a dramatic effect on the density profile, which can be derived explicitly [3]. In addition the local density approximation allows for the inclusion of correlations, which further improves the results in the regime of large screening [4]. Comparisons with MD simulations of Yukawa balls show excellent agreement.


1Support by the DFG (via SFB-TR24) is acknowledged

Christian Henning
ITAP, University of Kiel

Date submitted: 21 Jul 2007

Electronic form version 1.4