

Density of dusty particles with Yukawa interaction in electro-gravitational trap

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Behavior of the various objects in a finite volume or in a restricted space is a fascinating problem in physics and biology. Usually interaction of these objects is essential for their behavior and, in particular, for density distribution. The typical examples of particles confinement in physics are the hot plasma particles in stellarator and in Tokomak, dusty plasmas in electromagnetic and gravitational traps, ultra-cold Bose and Fermi gases.

In the present report we focus on the charged dusty particles, which interact by some short-range potential (e.g., Yukawa potential) and placed in some confined potential field, which can be formed by a combination of the self-consistent electrical field and the gravitational field. Depending on the interaction potential, the trap properties and the external parameters dusty particles can be in the ordered or in the disordered states. On the basis of density functional approach we investigated analytically and numerically the temperature dependence of the dust particle density of the externally confined one-component Yukawa plasma. The various type of traps, different dust temperature and screening parameter have been considered. The notion of average density for the dusty particles in disordered state is introduced for the considering traps. The results are qualitatively compared with the results of the recent experiments on temperature dependence of the dust density in cryogenic discharge.