Thematic area of the work (nanocomposites and nanomaterials)

Layered structures of charges in classical Coulomb clusters

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Configurations of charges in mesoscopic and cluster systems are strongly dependent on the nature and profiles of confining potentials at low temperatures [1,2]. In present work we deal with neutral clusters and use the electrostatic confinement originated from the uniform cylindrical background. Model system is specified by a number N of charge units $-e$ confined, by length $2L$, radius R, and a whole charge eN_b of a background. In neutral clusters $N_b = N$. Equilibrium structures announced in the title above were obtained in numerical calculations and some of them are shown in Fig.1.

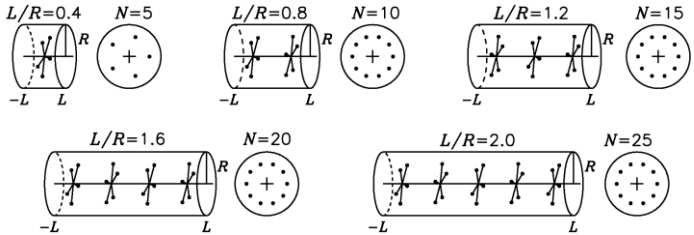

Fig.1. Structures in neutral clusters with $N=5k$ *and* $L/R=0.4k$ (k=1–5).

Self-organization of structures into layered associations is caused here by the formation of the Coulomb barriers in self-consistent potential patterns. In structures with $N \geq 20$ the layers are aligned with cluster axes with an accuracy of 0.01%. In all cases $N > 5$ the spiral symmetry on a limited length scale is clearly pronounced.

1. *Dubin D.H.E.,O'Neil T.M.* Trapped nonneutral plasmas, liquids, and crystals (the thermal equilibrium states) // Rev Mod Phys.-1999.-**71**, N 1.-P. 87-172.
2. *Piacente G.,Hai G.Q.,Peeters F.M.* Continuous structural transitions in quasi-one-dimensional classical Wigner crystals // Phys Rev B.-2010.-**81**, N 2.-P. 024108(5).