

## P2.3008 Inhomogeneity of structural and dynamic properties of dusty plasma structures

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See the full abstract here

<http://ocs.ciemat.es/EPS2019ABS/pdf/P2.3008.pdf>

Dusty plasma is a system of charged micron-sized particles immersed in a plasma. This system is strongly non-ideal due to high charges of particles and strong interaction between them. Thus, observation of ordered structures in a dusty plasma is possible. Such ordered structures are called dusty plasma crystals.

The configuration of dusty plasma crystals is often well described by the model of particles interacting through the Yukawa potential inside of a parabolic trap [1]. As was shown by Henning et al. [2], such crystals are fundamentally nonuniform: mean inter-particle separation is higher at the periphery of the structure than in its center.

In this work, we extend analysis to dynamics properties (root mean square displacement, Lindemann parameter, diffusion coefficient in a liquid state) and coupling parameter of confined Yukawa system. We develop an analytic model demonstrating that the listed dynamic properties are also nonuniform and grow with radial distance from the center of the trap while the coupling parameter decreases. In order to verify this effect, we conduct molecular dynamics simulations on two-dimensional and three-dimensional systems. Results of MD simulations show a good agreement with the analytic model. Influence of charge fluctuations on the dynamics properties and coupling parameter is also discussed.

From the nonuniformity of confined Yukawa structures, it is shown that the process of melting in them is fundamentally heterogeneous and starts from the periphery of the structure.

1. Baumgartner, H., Block, D., & Bonitz, M. (2009). Structure and phase transitions of Yukawa balls. *Contributions to Plasma Physics*, 49(4-5), 281-302.
2. Henning, C., Baumgartner, H., Piel, A., Ludwig, P., Golubnichiy, V., Bonitz, M., & Block, D. (2006). Ground state of a confined Yukawa plasma. *Physical Review E*, 74(5), 056403.

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