DETERMINING THE POTENTIAL OF INTER-PARTICLE INTERACTION IN DUSTY-PLASMA STRUCTURES OF THE SHEATH REGION OF RF- DISCHARGE

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The purpose of the given work was a first experimental approbation of a new technique of restoration the parameters of dusty-plasma systems in laboratory plasma [1, 2]. The fundamental idea of the techniques is to solve the inverse problem describing movement of dust particles by a system of Langevin equations and also allows determining the friction coefficient and the external confining potential. The technique is based on an analysis of the information on coordinates and displacement of particles that can be easily found both in numerical and in real experiments.

With the use of numerical simulation we have considered some special features of the application of the proposed method in the laboratory dusty plasma, such as the duration of experiments, the visualization of a part of dust cloud, the time and the spatial resolution of a particle motion.

The experimental approbation of the technique was carried out for dust clusters consisting of 11–29 grains and for extended dust clouds (~550 registered grains) in the sheath region of RF- discharge. The obtained potential of dust clusters is in a good accordance with the Coulomb interaction of grains ($\varphi(l) \propto l^{-1}$). The similar asymptotic behavior was also obtained for extended dust clouds for $l > 2l_p$, where l_p is the mean inter-particle distance. The obtained power law, ($\varphi(l) \propto l^{-1}$), may be related to a weak screening of dust under experimental conditions, or can provides a proof of validity of the results of series of works [3, 4].

Additionally we have considered a question of application of the proposed technique for determining parameters of attraction forces that probably exist in dusty-plasma systems.

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