15th International Conference on the Physics of Non-Ideal Plasmas Almaty, August 30- September 4, 2015

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Book of Abstracts

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Voids in dusty plasma of a stratified DC glow discharge

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The experimental investigations of the dusty plasma parameters of a DC glow discharge were performed in laboratory conditions. In the strong electric field of a stratified positive column in a vertically oriented discharge tube the clouds of dust particles levitated. Under some conditions the dust free regions (voids) were formed in the center of the dust particles clouds (i.e. at the axis of the discharge tube).

A model for the positive column of a DC glow discharge in inert gases with dust particles is presented. The model is based on the previously developed model [1,2] with the dust particles motion sub-model. The non-local Boltzmann equation for the electron energy distribution function, drift-diffusion equations for ions and dust particles, and the Poisson equation for electric field were calculated self-consistently. The electrostatic force confining the dust clouds at the axis of the discharge tube, the ion drag force acting on dust particles towards the discharge tube wall, the inter-particle repulsive force were taken into account.

The behavior of voids formation was investigated for different discharge conditions (sort of gas, discharge pressure and discharge current) and dust particles parameters (particles radii and particles total number). The radial distributions of dusty plasma parameters in a dust cloud were calculated for different experimental conditions. It was shown that it is the ion drag force radial component that leads to the voids formation. Both experimental and calculated results show that the higher the discharge current the wider dust-free region (void) is formed. The calculations also show that more pronounced voids are formed for dust particles with larger radii and under lower gas pressures.

References

[1] G.I. Sukhinin, A.V. Fedoseev, S.N. Antipov, O.F. Petrov, V.E. Fortov, *Phys. Rev. E*, 2013, 87, 013101
[2] G.I. Sukhinin, A.V. Fedoseev, M.V. Salnikov, S.N. Antipov, O.F. Petrov, V.E. Fortov, *EPL*, 2013, 103, 35001