STUDY OF THE DISTRIBUTION OF GAS DISCHARGE PLASMA PARAMETERS AROUND CHAIN STRUCTURES OF DUST PARTICLES

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Dusty plasma is a weakly ionized gas, which contains particles of a condensed state of micron and submicron sizes. Such particles, being in a plasma environment, are charged negatively due to the difference in the mobility of the ionic and electronic components of the plasma. Dusty plasma is observed in outer space, in comet tails and in planetary rings, and it is actively studied in laboratories. The reason why the dusty plasma attracts researchers' attention is the unusualness of the observed phenomena. For example, dust particles can self-organize into complex ordered structures, such as chains or crystal-like structures. Moreover, the transfer of energy from the plasma subsystem to the energy of dust particles is observed in dusty plasma systems, that makes it an example of active matter. In addition, dusty plasma is used in practical application. In the method of spraying surfaces in a high electric field, dusty plasma is generated to produce varnish drops which cover the sprayed surface. In this paper, we theoretically investigate the problem of the distribution of the gas discharge plasma around the chain structures of dust particles for different parameters of the dust-plasma system. We obtain the charge density and the electric potential distribution around the dust particles, and the distribution of the charges of the dust particles in the chain. It is shown that the charge of dust particles in the chain decreases monotonically in the direction of the ion flow. For theoretical research, we use numerical simulation of the ion dynamics according to [1]. It is assumed that electrons have a Boltzmann distribution, ions undergo pair collisions with neutral gas molecules by the mechanism of resonant charge exchange.

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1. Piel A. Molecular dynamics simulation of ion flows around microparticles //Phys. Plasmas 2017. V. 24. No. 3. P. 033712.