Charging processes of dust particles in magnetized gas discharge plasma

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Investigation of the dust particle charging processes is one of the key problems in dusty plasma physics, that provides the information about charge and interaction potential of dust particles. This information is necessary for constructing dusty plasma theory, that can describe the formation, existence, evolution and destruction of ordered plasma-dust structures[1]. This theory also needed for describing the dynamic phenomena in plasma.

Recent experiments have been conducted to study the charging processes of dust particles in a magnetized plasma [2]. In the presence of strong magnetic field it is obtained that the absolute value of dust particle charges is much lower than the estimations of the OML theoretical model.

In this regard, the purpose of this work is to study the influence of magnetic field on the dust particle charge in gas-discharge plasma. The influence of magnetic field on the dust particle charge, on the charge fluctuation and on the charging time are investigated.

The charge of dust particle is determined by the particle-in-cell method and the collision of ions with atoms is taken into account by the method of Monte Carlo [3,4]. Calculations are made for the following gas discharge plasma parameters: the electron and ion densities are 10^9 cm^{-3}, the electron temperature is 3 eV and for ions is 0.03 eV. The charges of dust particles with the radius of 0.5, 1, 2, 4, 8, 10 μm were calculated at magnetic field values in the range B = $4*10^3 \div 10^5 G$. The dependence of the dust particle charge on time, as well as their charging time at different values of the magnetic field are obtained.

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