Dusty Plasma Structures in Magnetic Fields in Strata of a dc Glow Discharge

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The formation of dusty plasma structures has been experimentally investigated in a cylindrical dc discharge in axial magnetic fields. The maximum magnetic field 2500 G at which the standing strata are still kept, is reached for discharge in hydrogen at pressure of several tenths of Torr. However, the dust grain structures in hydrogen were recorded only in fields up to 1000 G, and they had the form of a plane monolayer. Small bulk structures (~10^2 grains) were obtained in strata of a discharge in neon. They rotated about the discharge symmetry axis with a frequency depending on the magnetic field *B*. At $B \approx 500$ G, the direction of the rotation was changed. When the field increases to 700 G, the displacement of dust grains from the axial region of the discharge to periphery along with the continuation of rotation has been observed. Rotation of the structures containing ~10^3 dust grains in fields up to 300 G was not observed, and with the further increase in the field the grains fall out of the structure. For such structures, the kinetic temperatures of the dust particles, the diffusion coefficients, and the effective nonideality parameter have been determined from the video observation results for various magnetic fields. The explanation of the features in the behavior of the dust grains in the discharge in magnetic field has been proposed on the basis of the analysis of ambipolar diffusion in the magnetized plasma. It has been shown that the inversion of the dusty plasma structure rotation is related with the increase of the relative role of the recombination on the grain surface in comparison with that on the discharge tube walls when the plasma become more magnetized. The maximum magnetic field at which the levitation of the dust grains in the discharge is possible has been estimated.