

The effect of magnetic field on plasma particles in dusty plasma

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There is considerable interest in the study of complex plasmas in a magnetic field [1-2], including a fairly strong one [3-5]. It is important to understand how the presence of a dust component can affect the properties of a plasma in magnetic field. By analogy with the effect on the operation of electrical probes, the presence of dust particles complicates the magnetization of the plasma components and, affects the charging and dynamics of the particles.

The change in the characteristics of motion and diffusion of charged particles in a magnetic field occurs when critical values are reached by several parameters. When $\omega_e \tau_e = 1$, the electron circulates around the cyclotron circle of radius $r_{ce} = \frac{m_e v_e}{eB}$ and is considered magnetized. Under typical conditions in experiments with a complex plasma, $\omega_e \tau_e = 1$ already in a field of the order of 10^{-2} T. In the presence of a dust particle with radius a , the determination of the magnetization becomes more complicated. To effectively hit electrons on the surface of dust particle, the condition $r_{ce}=a$ is required. The magnetic field corresponding to this condition does not depend on the pressure. For particles with a size of about 10 μm , it is performed in fields of the order of 1 T. The criterion for the magnetization of ions depends on their type. For neon, the condition $\omega_i \tau_i = 1$ is satisfied in fields of the order of $2 \cdot 10^{-1}$ T. The total magnetization of an ion in a complex plasma is realized when the condition $r_{ci}=a$ is satisfied. In helium, the field of about $B = 2.4$ T is required for the magnetization of the ion

In this paper, the results of the studies of dust formations are presented with the magnetization of the plasma component in the lightest inert gases. The experiment with neon is carried out on a superconducting magnet at pressures typical for dusty plasma in the dust trap in stratum. The experiment with helium is carried out in standard magnetic coils under reduced pressure in the trap near the narrowing of the current channel. In preliminary observations, the conditions of magnetization are achieved.

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