Study of the dynamics of dust structure in the region of narrowing of the current channel in helium in a strong magnetic field

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To study the magnetic properties of dusty plasma it is necessary to create a magnetic field corresponding to the magnetization of the ion component of the plasma and observe its effect on the dust structure. It is very attractive to use the lightest gas helium and a strong magnetic field.

The paper studies the dynamics of rotation of a plasma-dust structure formed in a glow discharge in helium in the area of narrowing of the current channel in a magnetic field of up to 1.5 T. The cyclotron radius of a helium ion at B = 1.5 T becomes less than the screening length. The rotation velocity of the volume dust structure in the central section of the discharge inside the insert narrowing the current channel is measured depending on the induction B. The correlation of the rotation velocity with the position of the structure inside the dust trap is observed. Two regions of the magnetic field in which the rotation velocity reaches 35 rad/s are found. These regions are significantly spaced on the magnetic field scale (about 1 T). Possible rotation mechanisms are qualitatively discussed. A model is proposed that assumes two mechanisms of dust particle rotation: ion drag and neutral gas drag.

The work was supported by the Russian Science Foundation, grant 22-72-10004.