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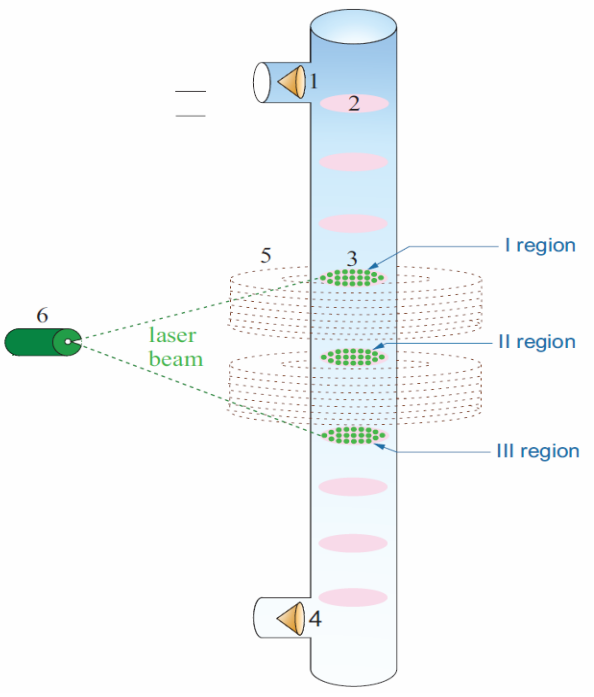
Plasma-dust structures in a DC discharge in magnetic field

A. Abdirakhmanov, M. Dosbolayev, T. Ramazanov

Al-Farabi Kazakh National University, Almaty, Kazakhstan
abdirakhmanov@physics.kz

At present, there are several theoretical assumptions that the rotation of the plasma-dust structures in the stratum in a magnetic field can be caused by the presence of a number of irregularities such as the inversion of the radial ion flux, which is related either to the local reversal of the field, or to the onset of recombination on the dust structure; the effect of narrowing current channel /1-2/ and edge effects /3/ In the experiment /2/, a narrowing current channel (insert) is used to reduce the influence of the cathode spot on discharge stability and the formation of standing striations, and its position determines the position of the first standing stratum above the insert, that is, the dust trap, in a convenient place for observation.



1-anode; 2-strata; 3-plasma-dust structures; 4-cathode; 5-coil; 6-laser;
Fig. 1 - Experimental setup

In this work, the influence of an external magnetic field on the dust structure of a glow discharge suspended in strata without a narrowing current channel (the diaphragm in the form of a cone) was investigated /4/. The results were obtained in the experimental setup for studying the properties of dusty plasma and plasma-dust structures in a glow discharge plasma (Fig. 1). Experimental condition: gas-argon, pressure P = 0.1-0.25 Torr, discharge current i = 0.5-1.5 mA, induction of external magnetic field B = 0-400 mT. As dust particles, polydisperse aluminum with a characteristic size of 1 to 10 μm was used /3/.

The measurement was carried out in three areas, above (I region), under (III region) and between (II region) coils. During the experiment, it was found that the dust structure in the first region rotates only clockwise. In the second region, where the dust structure is located between the two coils,

rotational motion is not detected. The dust structure located at the under the coils rotates counter-clockwise direction.

By the results of the experiment the rotational motion of dust structures was detected, which direction of rotation of dust structures depends on the position of the location of the magnetic coils. The dependence of the average angular velocity of dust structures on the induction of the magnetic field for different regions was obtained.

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