

Ring dust structures in a stratified glow discharge in a magnetic field

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We present experimental results on the formation of ring-shaped dusty structures in glow discharges and the effect of magnetic fields on them. At low discharge currents (≤ 4 mA), a disk-shaped dusty structure is formed in the central part of the discharge tube. As the current increases, a void appears in the center of the structure, and it takes the form of a ring. With a further current increase, the radius of the ring increases and it becomes narrower. When the magnetic field is turned on, the dusty structure starts to rotate. In our experiment, fields up to 16 mT are used. Such fields practically do not affect the shape and size of the structure, since the ion cyclotron frequency is much lower than the ion-atom collision frequency. Only the dust structure rotation velocity depends on the magnetic field. To create dust structures, polydisperse aluminum oxide (Al_2O_3) particles with a size of 14 μm were used. Based on the balance of forces acting on the dust particles in the radial direction, we have determined the predominant size of the particles forming the dust structure, depending on the discharge current. Larger-radius structures (at higher discharge currents) are formed, on average, by smaller particles.