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Acceleration Of Ions In Beam Plasma Discharge At a Low Magnetic Field. Coordination Of Energy Distributions Of Electrons And Ions

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In [1] a phenomenon of stable acceleration of ions in beam plasma discharge at a low magnetic field up to energies, on the order exceeding a thermal energy of electrons is revealed experimentally. The radial current of high energy ion component makes an essential part of a total current of ions escaping the region of discharge, and the current density is inversely proportional to distance from a discharge axis. It means that these are the ions originated in axial area of discharge that are accelerated.

In the report [2] the results of computer simulation of beam instability development at parameters of a system, close in those in [1] are represented. The effect of formation of paraxial area of plasma with highly heated electrons is detected. Its high electrostatic potential determines acceleration of ions from this area to peripherals of discharge.

For verification of conclusions of numerical experiment the measurements of a velocity distribution function of electrons escaping area of discharge to its collector, together with energy distribution of ions which are running out from discharge on a normal to an axis are carried out. The effect of essential heating of electrons of plasma in paraxial area is detected in those regimes, when the acceleration of ions is observed. The temporal and space structure of high-frequency oscillations (in range $\omega \sim \omega_{pe}$) generated in discharge is researched. The effect of accumulation of a field of regular oscillations is detected in the region of injection of a beam and their stochastisation in process of propagation along the axis of system.

The results of physical experiments qualitatively correlate with the data of computer simulation.

References

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