Anomalous transport and domain instability of plasma

A.G. Oreshko

Moscow Aviation Institute, National Aerospace Research University, Moscow, Russia

In a number of experiments (breakdown near surface of dielectric, in a spark discharge, in a high-current discharges in atmosphere and in plasma of magnetically insulate diode[1]) author were registered electric domains. From virial theorem follows that the plasma as a system of particles always strives to move from a state with high values of energy (potential) to the state with the lowest values of energy (potential). In the process of transition in plasma the distribution of charges and fields adjusted self-consistently so that the work on transition becomes minimal. The process of transition is carried out the next way. The electrical domains appear in the plasma due to the inequality flows of directed drift of ions and electrons [2]. Between the regions of the electric domain is always set a strong electric field even for small voltages due to the smallness distance between the regions [2]. The origin of the electric domains in the plasma is accompanied by the generation of transverse electromagnetic waves [2]. In plasma laboratory, which is located in the chamber the reflected waves appear as a result of electromagnetic waves interaction outgoing from plasma with walls of chamber. Ultimately, as a result of interaction of the incident, reflected, and re-reflected waves in an oscillatory system the resonance of field strength is installed. The plasma goes into the state of anomalous diffusion across the longitudinal magnetic field. In experiments on investigation of the spreading (diffusion) of plasma in magnetic insulated diode of the accelerator was revealed that the velocity of plasma in a state of anomalous diffusion increased by order as compared with the velocity typical for classical diffusion. The generation of own microwave radiation of plasma was revealed in the range of wave lengths \(3 < \lambda < 6\text{cm}\) which is comparable to the diameter of the anode \(D_a = 5\text{cm}\). Thus, the frequency of own electromagnetic oscillations of plasma coincides with the characteristic frequency of resonator which is determined by the diameter anode (or chamber). The anode was hollow a resonator. In plasma there are different modes of generation of electrical domains, which are also characteristic for the plasma in semiconductors.

References
