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STRUCTURE OF THE EDGE PLASMA AND PERIPHERAL TRANSPORT IN QUASI-STATIONARY STELLARATORS *)

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When analyzing the peripheral plasma of magnetic traps, it is necessary to take into account a number of effects - non-diffusion processes, plasma turbulence and anomalous transport, the effect of radiation of impurities localized at the edge, recharge atom fluxes, thermal load on the wall [1].

The paper presents studies on quasi-stationary stellarators L-2 and L-2M. In the installations, plasma was created by the induction-free method of electronic cyclotron resonance (ECR) heating. In the L-2 installation, heating was carried out on the first harmonic of the gyro frequency with a wavelength of 8 mm (37.5 GHz) in the power range P = 0.07-0.18 MW and on the second harmonic of 4 mm (75 GHz), P = 0.07-0.28 MW. In the L-2M stellarator, heating was carried out at the second harmonic of the gyro frequency (75 GHz) with the MIG-2 and MIG-3 gyrotron complexes in a wide power range P = 0.05 – 1 MW. In the work presented, a comparative analysis of the results obtained on L-2 and L-2M is carried out.

Previously, the properties of peripheral plasma were studied in detail on the L-2 stellarator. A strong dependence of the parameters of the wall plasma on plasma heating methods was revealed. The transfer at the plasma edge was largely determined by turbulence [2]. A study was also conducted with the MIG-3 gyrotron complex in modulation modes, and measurements of the edge turbulence revealed intermittent structures [3]. A possible explanation for such phenomena is the filamentation mechanism [4].

The structure of the electric field and turbulent flow in the wall plasma measured by Langmuir probes is analyzed. The analysis of fluctuations of plasma wall parameters – magnetic field, electric potential and plasma density and their evolution during discharges is also given. Probes, reflectometry and gyrotron radiation scattering were used to measure density fluctuations, and Mirnov coils were used to measure the fluctuating magnetic field. The relationship of changes in fluctuating plasma parameters with possible small–scale instabilities - temperature gradient and peeling modes - is analyzed.

A comparison of transport modeling using models [5] (neoclassical transport taking into account the anomalous additive) and [6] (based on canonical pressure profiles) for the border region is presented. The possibility of developing electric unipolar arcs on the elements of the installation exposed to a maximum thermal load of ~ 0.5 MW/m2 [7] - a screw separator and a movable limiter is also analyzed.

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