SPONTANEOUS TRANSPORT TRANSITIONS AT THE MAXIMUM POWER OF ECR HEATING IN THE L-2M STELLARATOR PLASMA [[1]](#footnote-1)\*)

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The processes occurring in the current-free plasma inthe L-2M stellarator created by electron-cyclotron resonant heating by an unmodulated microwave pulse with a power of 0.3 to 1 MW [1], which is from 1 to 3 10-13W per particle, are considered.

When the threshold power of ECR heating is exceeded (~ 200 kW), spontaneous transitions begin to appear in the discharges, which can be described in the framework of magnetohydrodynamic peeling modes [2]. With a further increase in the heating power to 400-500 kW, the transitions are accompanied by an increase in the density and energy of the plasma, as well as bursts of radiation in the optical and X-ray ranges, as well as a drop in temperature. The maximum jump-like increase in energy and density was observed in the pulse immediately after boronization of the walls of the vacuum chamber. It is found that the increase in density and energy, as well as the cooling of the plasma, is associated with an increase in its interaction with the chamber walls.

With a further increase in the heating power, the discharge is non-stationary, as a result of which, at capacities of about 1 MW, it became necessary to move a graphite diaphragm into the plasma. In this conditions, the main plasma parameters have stabilized, but the plasma energy has significantly decreased; non-stationary processes are observed on radiation signals in the optical and X-ray ranges, as well as on the signal of the electric potential at the diaphragm. It is essential that the main heat load is on a narrow helical separatrice region of the wall of the vacuum chamber, an area of about 0.3 m2, where the load density is 1.5 MW/m2 With these values of heating on separatrice area of the vacuum chamber and the elements of the installation close to the plasma are developing unipolar microdose. Previously, high-frequency density perturbations in the edge region of the plasma were also observed, apparently associated with the appearance of arc discharges on the walls of the vacuum chamber [3].

The plasma energy at high heating powers corresponds to L-2M scaling [4] in pulses before transitions or without transitions, after which the energy and energy lifetime are reduced by 5-15 % compared to scaling. At a heating power of 500 kW, it is possible to obtain transitions in which, despite the significant cooling of the plasma due to short-term admixture of impurities, due to an increase in the average density by 1.5 times, it was possible to obtain an energy increase of 25% in dynamics.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Mu/ru/CF-Vasil'kov.docx) [↑](#footnote-ref-1)