Electron temperature profiles at the L-2m stellarator in experiments on the axial ERC plasma heating [[1]](#footnote-1)\*)

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For many years, the electron cyclotron resonance (ECR) heating at the second ECR harmonic (extraordinary wave) has been used at the L-2m stellarator for the creation and heating of hydrogen plasma. Currently, the plasma heating is performed using the MIG-3 gyrotron complex [1], which consists of two gyrotrons. The total microwave power absorbed in the plasma reaches 1 MW. Simulations of the microwave radiation absorption [2] have shown that, under conditions of the axial ECR heating (B/Bce=1), the profiles of the absorbed microwave power density turn out to be very narrow, close in shape to the Gaussian profile with a half-width at half-maximum of approximately Δx = 0.1⋅(r/ap). With such a narrow absorbed power profiles, it is natural to expect the rather peaked electron temperature profile decreasing sharply from the axis to the edge. However, in experiments on the axial ECR heating at the L-2M stellaratror, the electron temperature profiles observed are flat or even have a small dip in the axial region of the plasma column (r/ap < 0.4). To clarify the reasons for the occurrence of the flat profiles, we have analyzed the electron temperature profiles measured using the multi-chord SXR radiation diagnostics.

We have found out that the shape of the electron temperature profile primarily depends on the heating power reduced to the electron density ne = 1.0⋅1019м−3.

The bremsstrahlung of inhomogeneous plasma was simulated in order to find out whether the chord technique for measuring the SXR radiation under conditions of formation of the density profile with a dip near the plasma axis (such profiles are formed during ECR plasma heating at the L-2M stellarator) can significantly flatten the measured electron temperature profiles.

The electron temperature profiles with a small dip in the axial region of the plasma column (r/ap < 0.4) measured in experiments on the axial ECRH are similar to those measured in experiments on the off-axial ECRH B/Bce=1.05. This suggests that, under conditions of the axial ECRH, the profiles of the absorbed microwave power are not peak-shaped. Under these conditions, at rather high heating powers, the plasma density profiles have a dip in the vicinity of the plasma axis [1], and the profile of the absorbed power density has the peak in the region, where there is a reversed density gradient, that is, approximately at the half-radius of the plasma column. This can be due to the fact that, under plasma conditions when the density profiles have dips, the decay process is possible, during which the extraordinary wave can be transformed into the electron Bernstein wave, which is localized in the region of the reversed density gradient and, apparently, is absorbed in the same region [3].

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References

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3. E.Z. Gusakov, A.Yu. Popov, in *XLVII International Zvenigorod Conference on Plasma Physics and Controlled Fusion, Zvenigorod, 2020,* Book of Abstracts, p. 39.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Mu/ru/BB-Meshcheryakov.docx) [↑](#footnote-ref-1)