COMPARISON OF ENERGY TRANSport IN EC HEATed PLASMAs at the L-2M STELLARATOR AND T-10 TOKAMAK [[1]](#footnote-1)\*)

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1Dnestrovskij Yu.N., 1Melnikov A.V., 1Lysenko S.E., 2Meshcheryakov A.I., 1,2Kharchev N.K., 2GrebenshchikovS.E., 2Vafin I.Yu., 1CherkasovS.V., 1Eliseev L.G., 3SychugovD.Yu.

1NRC ‘Kurchatov Institute’, Moscow, Russia, Dnestrovskiy\_YN@nrcki.ru
2Prokhorov General Physics Institute, Moscow, Russia, meshch@fpl.gpi.ru
3Lomonosov Moscow State University, Moscow, Russia, sychugov@cs.msu.ru

In the L-2M stellarator and T-10 tokamak, plasma is heated at the second harmonic of electron cyclotron (EC) waves (X-mode). In [1] we introduce the conception of equivalent tokamak and stellarator discharges, which have the same electron and ion temperatures under the same totally absorbed ECH power. We extend this conception to the case of both complete and partial absorption of the ECH power [2]. In this paper, examples of equivalent experimental discharges of the L-2M stellarator and model discharges of the T-10 tokamak are considered. A feature of the L-2M is the small value of the rotational transformation at the plasma edge ((*а*) = 0.8), while in the W-7X, (*a*) = 1.2, and in the TJ-II (*a*) = 1.56 [1, 2]. Therefore, the parameter *q*(*a*) determined by the formula [1] have large values *q*(*a*) ~ 8 – 10. Another feature of the L-2M is the small plasma volume compared to the TJ-II. As a result, at a low plasma density, the specific power per electron turns out to be too high, and the electron distribution function is distorted. Suprathermal electrons appear, and the concept of temperature loses its meaning. The areas of occurrence of suprathermal electrons on the plane (*n* [1019 m-3], QEC MW]) are approximately separated from the areas with the Maxwellian distribution of electrons by an inclined straight line described by the equation , where *Q*EC is the input power, *n* is line average density (Fig. 1). In the region (A), the absorption of EC waves is partial; in region (B) is complete; in the region (C) suprathermal electrons appear; in the region (D), EC waves are strongly diffracted. The border between regions with complete and partial absorption is determined by the relation *n* = *n*cr, where , *B* is the magnetic field [T]. For a series of L-2M shots, the values of the absorbed power and the energy confinement time are determined. It is shown that the electron temperature and the absorbed power *Q*ab in equivalent discharges are the same. Figure 2 shows the heating efficiency η = *Q*ab/*Q*EC as a function of the plasma density for a series of L-2M shots.

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Fig. 1. Fig. 2.

References

1. Dnestrovskij Yu.N. et al. // Plasma Phys. Control. Fusion **63** (2021) 055012
2. Dnestrovskij Yu.N. et al. // XLIX International Zvenigorod Conference on Plasma Physics and Controlled Fusion ICPAF-2022. Book of abstracts, p. 61,
<http://www.fpl.gpi.ru/Zvenigorod/XLIX/Sbornik_ICPAF-2022.pdf>
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/AC-Dnestrovskiy.docx) [↑](#footnote-ref-1)