SPATIAL AND SPECTRAL CHARACTERISTICS of ELECTRON-CYCLOTRON power LOSSES IN TOKAMAKs WITH STRONG MAGNETIC FIELD (TRT, IGNITOR, etc.) [[1]](#footnote-1)\*)

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Progress in the development of a commercial thermonuclear reactor based on toroidal magnetic traps is associated with the need to increase the size of devices and the strength of the confining magnetic field [1]. This is necessary to achieve the conditions for plasma ignition, when the loss of energy from the plasma due to the heat conduction is compensated by the energy of alpha-particles generated in fusion reaction. The creation of such conditions, according to Lawson's criterion, requires that the triple product of the plasma density, the energy confinement time and the plasma temperature be greater than a certain threshold value, so that the frequency of occurring thermonuclear reactions provides a self-sustaining thermonuclear fusion reaction in a high-temperature plasma. Overcoming this threshold value is possible with an increase in the size of the device, in the magnitude of the magnetic field and the plasma temperature. At the same time, with an increase in the electron temperature and the strength of the confining magnetic field, the electron-cyclotron (EC) power losses greatly increase.

For the ITER tokamak under construction, an increase (in comparison with the existing devices) in the major torus radius, the magnitude of the magnetic field on the torus axis and the plasma temperature in steady-state scenarios of operation leads to the predicted increase in the role of EC radiation power losses in the local electron energy balance [2], [3]. Achieving the conditions for plasma ignition in relatively compact tokamaks is possible only with a significant increase in the magnetic field strength (2-4 times higher than the magnetic field in existing devices and in ITER). This idea underlies tokamaks such as the ALCATOR and the IGNITOR project [4], and will also be implemented in the Tokamak with Reactor Technologies (TRT) [5], [6]. A significant increase in the magnetic field strength in these devices requires a detailed analysis of the influence of this effect on the development of operating scenarios.

A comparative analysis of the role of EC radiation power losses in tokamaks with a strong magnetic field, namely TRT, IGNITOR and other projects, is carried out. It is shown that, despite a strong magnetic field, the EC power losses in IGNITOR and TRT tokamaks do not have a strong effect on the local electron energy balance and do not make a serious problem for a steady-state fusion burning.

References

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