ON THE EFFICIENCY OF LINEAR CONVERSION OF MICROWAVE RADIATION IN A LARGE-scale OPEN magnetic TRAP [[1]](#footnote-1)\*)

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Electron cyclotron resonance (ECR) plasma heating by microwave electromagnetic radiation is the simplest and most natural way of directing energy into the electron component of a plasma held in a magnetic trap. The increase in the electron temperature to 1 keV demonstrated by the GDL facility (BINP SB RAS, Novosibirsk) by ECR heating by radiation of two 54.5 GHz / 400 kW gyrotrons made it possible to significantly increase the lifetime of energetic ions in the trap by reducing the frequency of electron-ion collisions [1] and take a fresh look at the prospects of using large-scale open traps as sources of thermonuclear neutrons.

However, the use of direct methods of ECR heating, when waves introduced from a vacuum are absorbed in a plasma, encounters a number of limitations for promising axially symmetric traps of the next generation. The fact is that one of the advantages of an axially symmetric magnetic trap compared to other types of traps is a lower magnetic field in the main volume of the trap. Moreover, everywhere, except for the mirror assembly, the inequality $ω\_{p}>ω\_{B}$ holds, where $ω\_{p}$ and $ω\_{B}$ are the electron plasma and cyclotron frequencies, respectively. Moreover, in the central part of the trap, this inequality becomes strong. Consequently, for electromagnetic waves with a frequency higher than the plasma frequency, which can penetrate from the vacuum into the plasma, effective absorption is possible only near the mirrors, which is technically very inconvenient.

One of the ways to circumvent this limitation is the heating of plasma electrons by quasi-electrostatic waves, which are effectively absorbed even at high harmonics of the cyclotron resonance and can be excited in the plasma due to the linear transformation of electromagnetic waves in the vicinity of the upper hybrid resonance $ω\_{B}^{2}+ω\_{p}^{2}=ω^{2}$ [2].

For toroidal magnetic traps, such a process was predicted theoretically and experimentally demonstrated on a number of installations [3]. In this case, the heating efficiency is almost completely determined by the efficiency of conversion of an ordinary wave into a slow extraordinary wave in the vicinity of plasma resonance.

In this paper, we investigated the main features of such a conversion for the case of a large-scale axially symmetric magnetic trap, and analyzed the possibility of plasma heating due to the excitation of quasi-electrostatic oscillations in a GDL setup.

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References

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