LOSS MECHANISMS OF ENERGY ELECTRONS AND THE THRESHOLD OF KINETIC ELECTRON-CYCLOTRON INSTABILITIES IN AN open MAGNETIC TrAP [[1]](#footnote-1)\*)

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Gospodchikov E.D., Shalashov A.G., Izotov I.V.

Institute of Applied Physics RAS, Nizhniy Novgorod, Russia, egos@ipfran.ru

The development of kinetic electron cyclotron resonance (ECR) instabilities in a plasma confined in a open magnetic trap is responsible for a wide range of phenomena in both astrophysical and laboratory plasmas [1]. In particular, it was shown that such instabilities significantly limit the limiting parameters of operation of the ECR multiply charged ion sources [2].

Detailed experimental studies of ECR instabilities in laboratory mirror magnetic traps made it possible not only to demonstrate a controlled transition between the theoretically predicted modes of generation of microwave radiation in the nonlinear stage of the development of these instabilities, which is important from the point of view of optimizing the operation of ECR ion sources [3], but also allow a deeper study of the mechanisms energetic electron losses.

In the present work, within the framework of the concept of a cyclotron maser, we investigated the threshold for the development of ECR instabilities; it is shown that it is essentially determined by the ratio between the intensities of the "diffusion" and "slowing down" mechanisms for the loss of energetic electrons. It is shown that the theory reproduces the main features of the experimental dependences of the instability excitation threshold on the magnetic field in the trap. The relation between the characteristic times of pitch-angle diffusion and deceleration of energetic electrons in the ECRIS JYFL laboratory trap is found by comparison with experimental data.

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References

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