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INFLUENCE OF ELECTRON PRECIPITATIONS ON THE DYNAMICS OF KINETIC ELECTRON CYCLOTRON PLASMA INSTABILITIES IN AN OPEN LABORATORY MAGNETIC TRAP ^{*)}

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The development of kinetic electron cyclotron (EC) instabilities in a plasma confined in an open magnetic trap is the main mechanism for the loss of energetic electrons formed during sufficiently powerful EC resonance heating of the plasma [1]. In experiments, both continuous and quasi-periodic burst regimes of such precipitations were observed. At the ECRIS/JYFL installation (Finland) in 2022, it was shown that in a stationary EC discharge, X-ray signals, characteristic of precipitation of energetic electrons, have a two-periodic structure - the precipitation pulses were grouped into repeating series consisting of a fixed number of equidistant pulses, with a period the sequence of episodes was noticeably longer than their duration [2]. This type of behavior indicates the reverse influence of precipitation on the development of cyclotron instabilities through changes in the parameters of the main plasma.

In this work, within the framework of the cyclotron maser concept, the features of the “slow” dynamics of kinetic EC instabilities are discussed. It has been shown that the time evolution of the coefficient of inelastic loss of energetic electrons, reflecting the general drop in the average charge number of ions with the ambipolar potential restructuring accompanying the precipitation of energetic electrons [3], leads to the formation of a two-periodic structure of flares, which explains the experimental observations.

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References

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