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Microwave Emission from ECR Plasmas Under Conditions of Two-Frequency Heating Induced by Kinetic Instabilities.

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Multiple frequency heating is one of the most effective techniques to improve the performances of ECR ion sources. It has been demonstrated that the appearance of the periodic ion beam current oscillations in ECRIS at high heating power and low magnetic field gradient is associated with kinetic plasma instabilities. Recently it was proven that one of the main features of multiple frequency heating is connected with stabilizing effect, namely the suppression of electron cyclotron instability in ECRIS plasmas. Due to this kind of stabilization it is possible to run the ion source in stable mode using higher total microwave power and thus to obtain better ion beam parameters. Unfortunately, even with using of such technique at some threshold level the plasma becomes unstable. This work is devoted to experimental investigations of the peculiarities of cyclotron instability in the case of two-frequency heating. It was found out that the plasma microwave emission spectrum connected with the instability is affected by the division of injected power shared between the frequencies. The frequency with higher power was found to determine the microwave emission spectrum, which correlated fully with the spectrum obtained in single frequency operation with the given injected frequency.

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