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DUAL-FREQUENCY ECR HEATING IN COMPACT PLASMA SYSTEMS: CHALLENGES AND ADVANTAGES *)

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Heating of high-temperature plasma in laboratory magnetic traps under electron cyclotron resonance (ECR) conditions in a bichromatic field is of significant interest both for fundamental studies of the physics of interaction of electromagnetic waves with plasma, and for practical applications. The presence of two spatially separated ECR zones corresponding to different frequencies can be used to control the energy input profile and stabilize plasma in toroidal systems. On the other hand, the overlap of ECR zones, which is most naturally realized in open magnetic traps, ensures effective stochastization and broadening of the cyclotron interaction region in phase space. In this case, for example, due to the overlap of nearby cyclotron harmonics, it becomes possible to suppress the limitation of the maximum energy of accelerated electrons associated with the departure from resonance due to a relativistic increase in mass. This report focuses on a relatively new effect discovered in experiments with dual-frequency heating in compact technological magnetic traps used as ECR sources of multiply charged ions. The effect manifests itself in the form of a significant increase in the operating efficiency of such a source under conditions of suppression of kinetic instabilities caused by powerful microwave heating of the plasma.

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