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First Numerical Evidence of the Two-Close Frequency Heating Effect on Electron Cyclotron Resonance Ion Sources

The two-close frequency heating (TCFH) is a new implementation of the well-known two frequency heating. In TCFH, the two frequencies differ less than 200-300 MHz each other in order to establish two contiguous ECR resonance zones. TCFH has been proved to be a powerful technique to suppress plasma instabilities in Electron Cyclotron Resonance Ion Sources (ECRIS), as well as to improve their performances. Its beneficial effect, compared to the application of a single frequency, is always deduced from the extracted charge states distributions and from the detection of the plasma self-emission in the X-ray and microwave ranges. This paper presents the first approach to a numerical description of the two-close frequency effect, based on the relevant plasma parameters of the ECRIS setup operating at ATOMKI-Debrecen. Simulations have been performed by our PIC-Full Wave code, joining electron kinetics and FEM solution of Maxwell equations in a cold plasma model. Results on plasma electron density and energy distribution will be shown, together with a direct comparison with the already published data on X ray emission and extracted charge states distributions.

Funding Agency

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