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3D Particle-in-cell Modelling of ECRIS

To simulate the non-linear evolution in ECRIS more accurately, Particle-in-cell (PIC) method is preferred as it takes both plasma collective feedbacks and particle kinetic effects into account. To ensure the convergence of PIC simulation, a set of rigorous stability conditions must be satisfied. It will be agreed that achieving an ECRIS simulation from the start-up to a stable CW operation is beyond attainment. In order to make it practical and meantime retain the physical essence, a two-step simulation scheme with separate electron models is developed. Firstly, through the single particle approach the energetic electrons are confined and heated in the min-B structure until stable. Secondly, cold electrons and multi charged ions under the effect of plasma potential are calculated by an implicit electrostatic PIC model, and collision processes are also included with the Monte Carlo model. In this way, some aspects of ECR plasma distributions and potential are investigated.

E-mail for contact person

leili@std.uestc.edu.cn

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Primary authors: LEI, Li (University of Electronic Science and Technology of China); JIN, Xiaolin (University of Electronic Science and Technology of China)

Co-authors: LI, Jibo (Institute of Modern Physics); LI, Lixuan (Institute of Modern Physics)

Presenter: LEI, Li (University of Electronic Science and Technology of China)

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