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Numerical Analysis of the Influence of Plasma Parameters on the 1+ Beam Capture in the ECR-based Charge Breeder

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Electron Cyclotron Resonance-based charge breeding is a reliable and well-established technique to boost the charge states of radioactive ions produced in Isotope Separation Online (ISOL) Facilities. While its first applications relied on a pure experimental approach, the optimization of charge breeding has recently benefitted from numerical simulations guiding the experiments and providing insights into various steps of the process. Both approaches have proven very useful in pointing out the main physical mechanisms behind the process. Due to the complexity of the charge breeding process involving several steps such as the 1+ beam capture, step-wise ionization to high charge states and extraction of the high charge state ions, the experiments and simulations often deviate from each other. This contribution describes the latest results of numerical simulations with the aim of focussing on the role of the different plasma parameters on the overall capture efficiency, thus trying to merge in a unified description of both experimental and numerical evidences in qualitative terms. We describe the numerical approach, show that parameters like ion temperature, plasma density and potential (absolute value and profile) affect the simulated capture of the injected 1+ ions, discuss the experimental evidence corroborating the simulation results, and highlight discrepancies between experiments and simulations.

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