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Measurement of Ionization, Charge Exchange and ion Confinement Times in Charge Breeder ECR Ion Sources with Short Pulse 1+ Injection of Metal Ions

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The Consecutive Transients (CT) method has been developed to calculate the characteristic times of ionization, charge exchange and ion confinement within highly charged plasma of a Charge Breeder Electron Cyclotron Resonance Ion Source (CB-ECRIS). In the CT-method, 1+ ions are injected into the plasma in pulsed mode and fits are made to the resultant high charge state extraction current transients. An optimization procedure is then used to determine the plasma parameters from the fitting coefficients.

Results obtained with the CT-method are compared in two different CB-ECRIS operating configurations. It is shown that the differences in CB efficiencies between the two configurations (e.g. 8.9% and 20.4% for K9+) are explicable through the change in the characteristic times, which are themselves compatible with the nested-layer model of the spatial distribution of ions and electrostatic ion confinement.

E-mail for contact person

misapema@jyu.fi

Funding Information

Primary author: Mr LUNTINEN, Miha (University of Jyväskylä, Department of Physics)

Co-authors: KOIVISTO, Hannu (University of Jyväskylä); ANGOT, Julien (CNRS); TARVAINEN, Olli (STFC Rutherford Appleton Laboratory); THUILLIER, Thomas; TOIVANEN, Ville (University of Jyväskylä)

Presenter: Mr LUNTINEN, Miha (University of Jyväskylä, Department of Physics)

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