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Ion Extraction from a Toroidal Electron Cyclotron Resonance Ion Source: a Numerical Feasibility Study CLAUDIA CALIRI, FRANCESCO VOLPE, Columbia University, SANTO GAMMINO, DAVID MASCALI, INFN-LNS — Electron Cyclotron Resonance Ion Sources (ECRIS) are magnetic mirror plasmas of microwave-heated electrons and cold multi-charged ions. The ions are extracted from one end of the mirror and injected in accelerators for nuclear and particle physics studies, hadrontherapy, or neutral beam injection in fusion plasmas. ECRIS devices progressed to higher and higher ion currents and charge states by adopting stronger magnetic fields (beneficial for confinement) and proportionally higher ECR frequencies. Further improvements would require the attainment of "triple products" comparable with major fusion experiments. For this, we propose a new, toroidal rather than linear, ECRIS geometry, which would at the same time improve confinement and make better use of the magnetic field. Ion extraction is more complicated than from a linear device, but feasible, as our modeling indicates. Possible techniques involve charge-dependent drifts, divertors, specially designed magnetic fields and associated loss-cones, electrostatic and/or magnetic deflectors, or techniques used in accelerators to transfer particles from one storage ring or accelerator to the next. Here we present single-particle tracings assessing and comparing these extraction techniques.

Claudia Caliri
Columbia University

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