DPP11-2011-000275

Abstract for an Invited Paper
for the DPP11 Meeting of
the American Physical Society

Antihydrogen formation by autoresonant excitation of antiproton plasmas

WILLIAM BERTSCHE[1], Swansea University

In efforts to trap antihydrogen, a key problem is the vast disparity between the neutral trap energy scale ($\sim 50\,\mu$eV), and the energy scales associated with plasma confinement and space charge ($\sim 1\,$eV). In order to merge charged particle species for direct recombination, the larger energy scale must be overcome in a manner that minimizes the initial antihydrogen kinetic energy. This issue motivated the development of a novel injection technique utilizing the nonlinear nature of particle oscillations in our traps. We demonstrated controllable excitation of the center-of-mass longitudinal motion of a cold, dense antiproton plasma using a swept-frequency autoresonant drive. Antihydrogen was produced and trapped by using this technique to drive antiprotons into a positron plasma, thereby initiating atomic recombination. The nature of this injection overcomes some of the difficulties associated with matching the energies of the charged species used to produce antihydrogen. We present measurements and simulations that probe the dynamics of this mixing process as well as adjustments to the drive aimed at improving the likelihood of producing trapped antihydrogen.

[1]Stationed with ALPHA Collaboration, CERN