

Positron physics in antihydrogen production - a look to the future

Lars V. Jørgensen

Univ. of Wales Swansea, U.K. and CERN, Geneva, Switzerland

The generation of large and dense positron plasmas have played a crucial role in the success of antihydrogen physics thus far. The ability in ATHENA to tailor-make the positron plasmas to the desired size and density [1], while being able to verify these plasma characteristics non-destructively in real-time [2], have contributed to a much better theoretical understanding of the detailed formation process [3]. However, in order to perform the high precision tests of the CPT theorem that is the goal of most efforts in the field, it will be necessary to trap the neutral antihydrogen atom in a multipole magnetic trap. There are now serious questions concerning the stability of non-neutral plasmas in the presence of such higher order magnetic fields, particularly as concerns quadropole fields [4]. I will briefly explain how we plan to overcome these problems in the new ALPHA experiment and also how plans to upgrade the Antiproton Decelerator resulting in an increase in antiproton number by a factor of 100 [5] might affect the dynamics of antihydrogen formation.

[1] L. V. Jørgensen *et al.*, accepted for publication in *Phys. Rev. Lett.* (2005)

[2] M. Amoretti *et al.*, *Phys. Rev. Lett.* **91**, 55001 (2003)

[3] F. Robicheaux, *Phys. Rev. A* **70**, 022510 (2004)

[4] J. Fajans *et al.*, submitted to *Phys. Rev. Lett.* (2005)

[5] P. Belochitskii *et al.* Proposal to CERNs SPSC committee, *CERN-SPSC-2005-011*