

From ATHENA to ALPHA: Towards Trapping and Spectroscopy of Antihydrogen Atoms

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Since the last μ CF conference in 2001 [1], tremendous progress has been made in antihydrogen experiments at CERN's Antiproton Decelerator facility. The primary goal of these experiments is to make precision tests of matter-antimatter symmetry, in particular CPT invariance. In 2002, ATHENA experiment succeeded in producing and detecting cold antihydrogen atoms. These first cold anti-atoms, however, were not confined and annihilated on the trap walls shortly after their creation. In order to perform precision measurements, the stable trapping of antihydrogen is essential. This is the main goal of a new experiment ALPHA (Antihydrogen Laser Physics Apparatus). In this talk, I will discuss some of ATHENA's recent achievements [3], and the status and the prospects of ALPHA for fundamental physics with cold antihydrogen [4]. Relevance of some antiproton experiments to muon physics is also discussed.

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- [1] M.C. Fujiwara *et al.*, *Hyperfine Interact.* **138**, 153 (2001).
 - [2] M. Amoretti *et al.*, *Nature (London)* **419**, 456 (2002).
 - [3] M.C. Fujiwara *et al.*, *Phys. Rev. Lett.* **92**, 065005 (2004).
 - [4] G. Andreson *et al.*, *Phys. Rev. Lett.* **98**, 023402 (2007).