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Trapped Antihydrogen - Stable, Neutral Antimatter

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Antihydrogen, the bound state of an antiproton and a positron, can be used as a test-bed of fundamental symmetries. In particular, the CPT Theorem requires that hydrogen and antihydrogen have the same spectrum. The current experimental precision of measurements of hydrogen transition frequencies approaches 1 part in 10^15. Similarly precise antihydrogen spectroscopy would constitute a unique, model-independent test of CPT symmetry. Antihydrogen atoms have been produced in quantity at CERN since 2002, when the ATHENA collaboration demonstrated [1] how to mix cryogenic plasmas of antiprotons and positrons to produce low energy anti-atoms. In this colloquium I will discuss the newest development along the road to antihydrogen spectroscopy: magnetically trapped antihydrogen. In November of 2010 the ALPHA collaboration reported [2] the first trapping of antihydrogen atoms in a magnetic multipole trap. The atoms must be produced with an energy - in temperature units - of less than 0.5 K in order to be trapped. Shortly afterward, ALPHA demonstrated that it was possible to store trapped antihydrogen atoms for up to 1000 seconds [3]. I will discuss the many developments necessary to realise trapped antihydrogen, the ongoing efforts to resonantly interact with antihydrogen, and the future of antihydrogen physics at CERN.

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