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Search for Trapped Antihydrogen: First Candidate Events

Content :

Precision symmetry tests at low energies have played important roles in our understanding of fundamental interactions. ALPHA (Antihydrogen Laser Physics Apparatus) is an international project located at CERN, whose prime goal is to perform tests of CPT symmetry on antihydrogen. By precise spectroscopic comparisons of well-studied atomic hydrogen with its antimatter counterpart, we hope to probe indirectly physics at or beyond the Planck scale. High precision tests with antihydrogen would likely require samples of trapped antihydrogen atoms. While substantial numbers of antihydrogen atoms have been produced in several experiments, their trapping has not yet been achieved. It is the initial goal of ALPHA to demonstrate stable trapping of antihydrogen. In the ALPHA apparatus, cold plasmas of typically 3×10^4 antiprotons and of 4×10^6 positrons are mixed in a Penning trap to form cold antihydrogen. A multipolar magnetic trap of depth 0.5 Kelvin is superimposed on the Penning trap to confine the anti-atoms. The ALPHA experiment features a 30,000 channel silicon vertex detector in order to identify annihilations of the expected small number of trapped atoms.

Since its first beam in 2006, ALPHA has been making substantial progress towards trapping of antihydrogen. In 2009, we have reached, for the first time, the detection sensitivity and trap conditions for which observation of antihydrogen trapping can be realistically expected. In this talk, we will present results from that run, where we have observed first candidate events. The details of the detector analysis, as well as possible sources of background will be discussed. Prospects for precision CPT tests with trapped antihydrogen will also be discussed.

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