

Observation of the 1S-2S transition in trapped antihydrogen

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We report the first observation of an optical transition in atomic antimatter. The ALPHA experiment at CERN was designed to allow illumination of magnetically trapped antihydrogen for precision tests of fundamental symmetries. In this report we describe how we succeeded in detecting the resonant loss of antihydrogen when intense 243 nm laser light was tuned to be at resonance with the 1s to 2s transition in hydrogen. We describe how we use a cryogenic cavity enhanced frequency stabilized laser, and the significant improvements in the synthesis and trapping of antihydrogen that were critical to the success.

Using a frequency stabilized 243 nm laser we have succeeded in, for the first time, exciting the 1s 2s transition in trapped antihydrogen. With on average about 14 atoms trapped, in 11 series of trials, we compared the antihydrogen remaining as well as escaping from the trap while exposing the atoms to intense laser light either on the presumed

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