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TRIUMF & University of Victoria

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Abstract

The ALPHA project at the CERN AD is testing fundamental symmetries between matter and antimatter using trapped antihydrogen atoms. CPT conservation, which underpins our current theoretical framework, requires equality of the masses and charges of matter and its antimatter partners. The spectroscopy of the antihydrogen atom may be compared to the very precisely measured transitions in ordinary hydrogen, presenting a path to precision CPT tests.

In our 2016 run ALPHA trapped more than 8000 antihydrogen atoms, and they were held for up to 600s interrogation times. This compares with the 100 antiatoms that my 2014 talk at Uvic was based on. I will discuss the techniques involved. The 1S-2S transition in antihydrogen has been observed for the first time[1], and it agrees with its hydrogen counterpart within an uncertainty of 400 kHz or 0.2 ppb. The charge of the antihydrogen atom has been bounded below  $0.7 \cdot 10^{-9} e$ [2]. A value of  $1420.4 \pm 0.5$  MHz for the hyperfine interval has been obtained from observation of the positron spin resonance spectrum[3]. These measurements will be described together with their future prospects.

[1] M. Ahmadi et al., Nature 541, 506-510 (2017).

[2] M. Ahmadi et al., Nature 529, 373-376 (2016).

[3] M. Ahmadi et al., Nature 548, 66-69 (2017).

Wednesday, October 4, 2017

2:30 p.m.

Elliott Building

Room 167