

# Measurement of Properties of Antihydrogen with the ALPHA Trap

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

In our 2016 run we were able to trap more than 8000 antihydrogen atoms, and they can be held for a 600s laser interrogation time. 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]. New data under analysis is expected to reduce the 100MHz uncertainty in the present PSR hyperfine transition measurement[3] by more than 2 orders of magnitude. 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] C. Amole et al., Nature 483, 439-443 (2012).

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