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Status of the Antihydrogen Hyperfine Structure Measurement in ASACUSA

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On behalf of the ASACUSA-CUSP Collaboration

The ASACUSA-CUSP collaboration at the CERN antiproton Decelerator (AD) aims at probing CPT symmetry through the precise comparison of hyperfine transitions in hydrogen and its CPT-conjugate: antihydrogen. The ground state hyperfine transition in hydrogen has been measured more than half a century ago in a beam with a relative precision of 4 × 10e−8 [1] and later to a much improved relative precision of 10e−12 in a maser [2]. Given the inapplicability of the latter for antimatter, the ASACUSA-CUSP collaboration has adopted a similar experimental concept for the measurement of the hyperfine splitting of antihydrogen as the 1950's measurement in hydrogen : a polarized beam of antihydrogen interacts with a microwave field within a cavity which on resonance drives the hyperfine transition [3]. This method benefits, over measurements with trapped antihydrogen atoms, from the high magnetic field homogeneity achievable in the region where atoms undergo the transitions and hence has the potential to reach a ppm-level precision with a relatively low number of antihydrogen atoms detected.
After the recent production of antihydrogen atoms [4] and their detection in a magnetic field-free region [5] 2.7m away from the ASACUSA antihydrogen production trap, efforts have been dedicated to the upgrade of the apparatus in order to produce an intense beam of antihydrogen and for its efficient detection.
In parallel to those developments the spectroscopy apparatus [6] was tested with a source of cold polarized hydrogen. This confirmed the high precision and accuracy which can be achieved [7].
After shortly describing the experimental setup and discussing its sensitivity, I will highlight the latest developments and the upcoming experimental challenges.

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