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Precision measurements of fundamental properties of the antiproton - BASE Experiment

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Comparisons of the fundamental properties of protons and antiprotons constitute sensitive tests of CPT invariance being of one of the most fundamental symmetries in the Standard Model.

The Baryon Antibaryon Symmetry Experiment (BASE) located at the antiproton decelerator of CERN is dedicated to determine the proton-to-antiproton charge-to-mass ratio and the magnetic moment of the antiproton with highest precision.

Based on alternating cyclotron frequency measurements on single negatively charged hydrogen ions and single antiprotons in an advanced Penning trap we reported very recently on a comparison of the proton-to-antiproton charge-to-mass ratio with a fractional precision of 69 parts per trillion.

Currently we focus on the high-precision measurement of the magnetic moment of the antiproton. Its value can be determined by measuring the frequency ratio of the spin-precession to cyclotron frequency of a single particle. By using the elegant double-trap measurement scheme we performed the currently most precise measurement of the proton magnetic moment with a fractional precision of 3.3 parts per billion. This scheme is directly applicable to the antiproton and currently being implemented into the BASE setup to determine the antiproton magnetic moment with p.p.b. precision and to thus provide a 1000-fold improved test of CPT invariance.

An overview of the recent results and the current progress of the BASE experiment is presented in this talk.

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