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Towards Sympathetic Cooling of Single Protons and Antiprotons

Wednesday 15 January 2020 12:00 (15 minutes)

We, the BASE collaboration, perform most precise tests of the CPT symmetry in the baryon sector by measurements of the fundamental properties of protons and antiprotons. Our recent 300 ppt measurement of the proton magnetic moment at the proton g-factor experiment in Mainz is predominantly limited by statistics [1]. The reason is that the current use of sub-thermal cooling of a single proton by a resistive method is extremely time-consuming and leads to cycle times of hours.

To overcome this limitation, sympathetic cooling by laser-cooled Be^+ ions in a common-end-cap Penning trap is being developed [2]: The method not only promises to produce protons and antiprotons with mK temperatures within tens of seconds but also achieves separation of the cooled and the refrigerator ion.

We present the current setup of the proton g-factor experiment and report on the status and recent achievements, such as in-trap detection of fluorescence photons using SiPMs at 4 K, located 12 mm from the Be+ ion cloud.

[1] Schneider, G. et al., Science 358, 1081 (2017)
[2] Bohman, M. et al., J. Mod. Opt. 65, 568 (2017)

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