Contribution ID: **65** Type: **Poster**

Sympathetic cooling of charged particles in separate Penning traps

Monday 3 July 2023 21:00 (2 hours)

The observed matter-antimatter asymmetry in the universe has yet to be understood. The experiments of the BASE Collaboration are dedicated to rigorous tests of the fundamental CPT symmetry in order to tackle this mystery. For this purpose, BASE compares the properties of the proton and the antiproton with highest accuracy, specifically the magnetic moments/g-factors [1,2] and the charge-to-mass ratios [3]. Cooling the proton and antiproton has been a limitation in previous measurements. Deterministically reaching the 10 mK range on short interaction time scales will considerably increase the sampling rate and boost the fractional accuracy that is reached in our experiment.

Direct laser cooling of ions gives access to the mK range or even beyond, and it is the method of choice in many precision experiments. In our case, a suitable laser cooling transition is missing. We recently demonstrated an alternative and novel approach by sympathetically cooling a single proton via induced image currents of a laser-cooled Be+ cloud located in a separate trap [4]. This concept is highly promising, because it allows to cool any kind of charged particles, including molecules, highly charged ions, and importantly charged particles of opposite charge such as the antiproton.

This contribution will summarize our previous work [4,5] and report on recent progress and results.

[1] G. Schneider et al., Science 358, 6366, (2017).
[2] C. Smorra et al., Nature 550, 371-374 (2017).
[3] M. J. Borchert et al., Nature 601, 53-57 (2022).
[4] M. Bohman et al., Nature 596, 514–518 (2021).
[5] C. Will et al., New J. Phys. 24, 033021 (2022).

Authors: SMORRA, Christian; WILL, Christian; YILDIZ, Hüseyin; Prof. WALZ, Jochen (Johannes-Gutenberg-Universität Mainz); WIESINGER, Markus (Max Planck Society (DE)); MICKE, Peter

Co-authors: MOOSER, Andreas (Max-Planck-Gesellschaft (DE)); Dr SOTER, Anna (ETH Zürich); LATACZ, Barbara Maria (CERN; RIKEN, Ulmer Fundamental Symmetries Laboratory, Japan); OSPELKAUS, Christian (Leibniz Universitaet Hannover (DE)); POPPER, Daniel; WURSTEN, Elise (RIKEN); ABBASS, Fatma; UMBRAZUNAS, Gilbertas (ETH Zurich (CH)); DEVLIN, Jack (Imperial College (GB)); JAEGER, Julia Ines (Heidelberg University (DE)); BLAUM, Klaus (Max Planck Society (DE)); FLECK, Markus (RIKEN (JP)); BORCHERT, Matthias Joachim (Leibniz Universitaet Hannover (DE)); ERLEWEIN, Stefan (Max Planck Society (DE)); Prof. ULMER, Stefan (RIKEN (JP)); QUINT, Wolfgang Peter (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE)); YAMAZAKI, Yasu (RIKEN (JP)); MATSUDA, Yasuyuki (University of Tokyo (JP))

Presenter: YILDIZ, Hüseyin

Session Classification: Poster Session 1