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Sympathetic cooling of positrons with laser-cooled beryllium ions

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Precision measurements on antihydrogen allow for testing CPT symmetry. The ALPHA Collaboration at CERN performs laser spectroscopy of antihydrogen in a magnetic minimum trap in order to compare its energy level structure to that of hydrogen [1, 2, 3]. Antihydrogen atoms are produced by three-body recombination of an antiproton and two positrons [4]. Antiprotons are provided in the form of a beam by CERN's Antiproton Decelerator, while positrons are obtained from the Na-22 radioactive source and stored in a Surko-type accumulator. Due to our magnetic potential well depth, we can trap only H atoms of energy below 0.5K. Decreasing the positron temperature could lead to an increase in the antihydrogen trapping rate [5]. Our proposed technique is sympathetic cooling of positrons with laser-cooled beryllium ions 9Be+ [6, 7]. Ions are created by ablating a beryllium foil with a short laser pulse and are subsequently caught in the ALPHA-2 Penning Trap, which is superimposed with the antihydrogen magnetic trap. We Doppler cool ≤ 600k ions with a 313nm laser and merge them with about 3.5M positrons.
We have demonstrated sympathetic cooling of positrons to around 10K, which is half of the temperature that we normally use during antihydrogen production. We will present the experimental scheme and our latest results.

[1] ALPHA Collaboration, Nature 557, 71-75 (2018).
[2] ALPHA Collaboration, Nature 548, 66-69 (2017).
[3] ALPHA Collaboration, Nature 561, 211-215 (2018).
[4] W.A. Bertsche et al., Jour. Phys. B 48, 231001 (2015).
[5] ALPHA Collaboration, Nature Communications 8, 681 (2017).
[6] B. M. Jelenkovic et al., Phys. Rev. A 67, 063406 (2003).
[7] N. Madsen et al., New J. Phys 16, 063046 (2014).

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