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Laser-cooled Be^+ for sympathetic cooling of e^+ for Antihydrogen formation[1] NIELS MADSEN, DANIEL THOMAS MAXWELL, JACK MCCAULEY JONES, JOANNA PESZKA, Swansea University, ALPHA COLLABORATION — Antihydrogen, the antimatter counterpart of hydrogen, is an exciting system for testing fundamental symmetries such a CPT (Charge, Parity and Time) and the weak equivalence principle. The ALPHA collaboration has in recent years made the first precision measurements of both the ground state hyperfine splitting and the ground (1S) to first excited stated (2S) two photon transition in antihydrogen. In addition, ALPHA has recently expanded its discovery potential by adding an apparatus allowing for direct tests of the gravitational acceleration of antihydrogen, thus testing the weak equivalence principle. These initial measurements have benefitted from increased trapping rates of antihydrogen achieved principally by using colder positrons. We present the result of an effort to load and laser-cool Be^+ ions in the challenging environment of an apparatus used for antihydrogen formation and trapping. The laser-cooled Be^+ ions are used to sympathetically cool positrons, to achieve even colder positron plasmas than possible through strategies based on cyclotron cooling in the strong magnetic fields used in these experiments. Experimental evidence suggests that even a small reduction in the temperature of the positrons used for antihydrogen formation will greatly enhance the antihydrogen trapping efficiency, suggesting that this approach could increase the amount of antihydrogen available for experimentation by at least an order of magnitude.

[1]EPSRC

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