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Antihydrogen trapping assisted by sympathetically cooled positrons NIELS MADSEN, Swansea University, SVANTE JONSELL, Stockholm University, FRANCIS ROBICHEAUX, University of Purdue — Antihydrogen formed by carefully merging cold plasmas of positrons and antiprotons has recently been trapped in magnetic traps. The efficiency of trapping is strongly influenced by the temperature of the nascent antihydrogen, which, to be trapped, much have a kinetic energy less than the trap depth of $\sim$0.5 K$\cdot k_B$. In the conditions in the ALPHA experiment the antihydrogen temperature seems dominated by the temperature of the positron plasma used for the synthesis. Cold positrons are therefore of paramount interest in these experiments. In this article we investigate an alternative route to make ultra-cold positrons for enhanced antihydrogen trapping. We propose to sympathetically cool the positrons by merging them with laser-cooled positive ions. We investigate the effectiveness of such cooling in conditions similar to those in ALPHA, and discuss how the formation of and the nascent antihydrogen may be influenced by the presence of positive ions. We argue that this scheme is a viable alternative to schemes such as evaporative and adiabatic cooling, and may overcome limitations faced by these schemes.

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