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Antihydrogen Induced Radial Redistribution of Antiprotons and Detection of Weakly Bound Antihydrogen NIELS MADSEN, Swansea University, ALPHA COLLABORATION — Attempts to trap antihydrogen ($\bar{H}$) in a magnetic minimum trap are ongoing. The $\bar{H}$s is typically formed through direct mixing of plasmas of positrons (e^+) and antiprotons ($\bar{p}$), as this, thus far, has shown the highest yields of $\bar{H}$. The formation is believed to be dominated by a process in which two e^+s interact with a $\bar{p}$, such that one e^+ becomes bound and the second carries away excess momentum and energy. This process is expected to generate relatively weakly bound $\bar{H}$. We have found that, when using direct mixing, field-ionization of the weakly-bound $\bar{H}$ by the external electric fields, leads to radial redistribution of the $\bar{p}$s. We can use this effect to efficiently detect these weakly bound $\bar{H}$, by intentionally causing $\bar{p}$s at large radii in our trap to be lost on the introduction of a strong transverse octupole magnetic field and monitoring the losses. This technique, together with the direct detection of strongly-bound $\bar{H}$ (bound enough that it survives the various trap electric fields), allows us to measure the fraction of $\bar{H}$ formed in strongly-bound states. Since it is these states which survive the electric fields necessary for synthesis, they are those available for trapping if cold enough. Using this technique we can therefore optimize the synthesis for maximum generation of strongly-bound, potentially-trappable states, and hence increase the likelihood of trapping.

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