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Towards a direct hydrogen-antihydrogen comparison

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The gravitational and spectroscopic properties of antihydrogen are being measured with ever increasing precision. The limits for such experiments are not expected to come from the measurement resolution, but rather from hard-to-characterise systematic effects. These could be overcome by directly comparing hydrogen and antihydrogen, i.e. measuring both species in the same trap, using the same lasers, and (at least on average) at the same time. Such a comparison requires a compatible hydrogen source and a suitable detection scheme.

I will present the results of a 1s-2s experiment with laser cooled antihydrogen, conducted using a measurement technique compatible with both hydrogen and antihydrogen. The scheme relied on ionising the atoms from the 2s level, recapturing the ions (antiprotons) in a nested Penning trap, and detecting them using a microchannel plate detector. I will also present a scheme to produce cold hydrogen atoms via threshold photodissociation of sympathetically cooled BaH⁺ molecular ions, and report on experimental efforts to realise this technique. The ion trap nature of the scheme makes it well suited for use in antihydrogen experiments.

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