Contribution ID: **5** Type: **Talk**

An Ion Trap Source of Ultracold Atomic Hydrogen via Photodissociation of the BaH+ Molecular Ion

Wednesday 29 June 2022 15:15 (22 minutes)

Hydrogen remains the go-to tool for testing fundamental physics, with the recent proton radius puzzle being a prime example. Here, I present a novel scheme for producing ultracold atomic hydrogen, based on threshold photodissociation of the BaH+ molecular ion. BaH+ can be sympathetically cooled using laser cooled Ba+ in an ion trap, before photodissociating it on the single photon A1Σ+⟵X1Σ+ transition. The small mass ratio between Ba+ and BaH+ ensures a strong overlap and efficient cooling, and the large mass ratio between BaH+ and H means that the released hydrogen will be 139 times colder than its parent molecular ion. I describe how the trap dynamics influence the energy of the hydrogen, and outline methods to optimise this. The low infrastructure costs and the ion trap nature of the scheme make it ideal for loading hydrogen into an antihydrogen exeriment, to support a direct matter-antimatter comparison.

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Session Classification: Antimatter

Track Classification: Antimatter