



## A.E.G.I.S. experiment - Antimatter laser cooling part

The AEGIS collaboration aims to create atoms of anti-hydrogen ( $\bar{H}$ ) and to study the impact of gravity force on it.

In a penning trap, a 3-body-reaction between an anti-proton and an atom of Positronium ( $\text{Ps} = e^+ + e^-$ ) forms an  $\bar{H}$ . Then,  $\bar{H}$  beam is horizontally accelerated to exit the trap and gravity measurements are performed via a deflectometer.

To improve the reaction efficiency and the gravity measurements, we are interesting in manipulating cold antimatter particles. We studied some ways to laser cool antimatter, and present in this poster two main simulations results:

- Positronium laser cooling? The main issue for cooling Ps is the short lifetimes which are involved: the fundamental triplet state of Ps (called ortho-Ps) has a lifetime of about 142ns. We performed 3D Doppler laser cooling simulations, and results seem to be encouraging!
- pbar and laser cooling? We also studied the possibility of sympathetic cool antiprotons via laser-cooled negative ions that are simultaneously confined in the same ion trap. We present here simulations results of laser cooled molecular anions ( $C_2^-$  species).

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