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Experiments with mid-heavy antiprotonic atoms in AEgIS

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Antiprotonic atoms have been fundamental in experiments which made the most precise data on the strong interaction between protons and antiprotons and of the neutron skin of many nuclei thanks to the clean annihilation signal. In most of these experiments, the capture process of low energy antiprotons was done in a dense target leading to a significant suppression of specific transitions between deeply bound levels that are of particular interest. In Particular, precise measurements of specific transitions in antiprotonic atoms with Z>2 are missing.
We propose to use the pulsed production scheme for the formation of cold antiprotonic atoms. This technique has been recently achieved experimentally for the production of antihydrogen at AEgIS. The proposed experiments will have sub-ns synchronization thanks to an improved control and acquisition system. The formation in vacuum guarantees the absence of Stark mixing or annihilation from high n states and together with the sub-ns synchronization would resolve the previous experimental limitations. It will be possible to access the whole chain of the evolution of the system from its formation until annihilation with significantly improved signal:background ratio. Moreover, the remaining highly-charged isotope can be trapped if the recoil from peripheral annihilation is sufficiently low. This could become an alternative path for production and measurement of several rare isotopes.
In the contribution I will discuss the experimental scheme and challenges as well as the opportunities and relevance for atomic, nuclear and particle physics.

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