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# Towards the study of antiprotonic atoms and their annihilation fragments at AEgIS

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On behalf of the AEgIS collaboration

The Antimatter Experiment: Gravity, Interferometry, Spectroscopy (AEgIS) at CERN's antimatter factory has achieved remarkable performance in trapping antiprotons for the pulsed creation of antihydrogen, as well as other antimatter-bound systems, such as positronium. Currently, a new technique is being developed using the AEgIS infrastructure to synthesize antiprotonic atoms, where an antiproton (1836 times the mass of the electron) is captured in close orbits around the atomic nucleus. This synthesis, performed within a Penning-Malmberg trap, enables novel studies of antiprotonic atoms in an ultra-high vacuum environment. It facilitates the creation of highly excited Rydberg antiprotonic atoms and, following annihilation, the capture of the resulting highly charged nuclear fragments. The study of these fragments offers unique insight into the annihilation mechanism, nuclear structure properties, and provides a new tool to synthesize radioactive highly charged ions (HCIs) in a trapped environment. In this talk, I will describe the proof-of-principle studies and the ongoing efforts towards the development of this new technique.

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