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## Cosmic anti-deuteron observation in space with a gas He detector

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The formation of low-energy anti-deuterons in cosmic ray collisions with the Interstellar Medium (ISM) is kinetically unfavored, while several Dark Matter (DM) models foresee the production of these light nuclei even at low energy.

The search of cosmic anti-deuterons in the kinetic energy range from a few MeV to several hundred MeV is an interesting channel for DM indirect observation. Currently, the balloon-borne GAPS experiment pursues the detection of cosmic anti-deuteron, and its major limitation is the exposure, limited by the availability and the duration of the balloon flights.

We here present a space mission based on a different detection approach and on modularity as mean to ease access to space and incrementally build larger acceptance.

The detection principle, already illustrated by us, is the capture by He atoms of anti-protons or anti-deuteron at rest into special atomic orbitals.

An anti-proton or anti-deuteron losing energy while crossing gaseous He induces a scintillation signal, if this anti-particle enters into an atomic orbital (~ 3% prob), it annihilates with a considerable delay. When this occurs, there is a characteristic delayed coincidence that is a strong signature of this occurrence over the background.

The amplitude of the second signal allows for distinguishing between the anti-proton and the anti-deuteron events.

In this talk, I will report on the progress made in detecting the UV scintillation light from the gaseous He.

I will then discuss the plan to design a small satellite holding the He vessel, shield by scintillator ToF, and some basic avionics as a module for more advanced missions where we would deploy a constellation of several satellites to increase the exposure factor.

In our approach, the effort to design, build, and qualify a satellite is sustained only once.

The required acceptance/exposure factor can then be achieved at reduced costs, and opportunity vector launches may also be profitably used.

### Eligibility for "Best presentation for young researcher" or "Best poster for young researcher" prize

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