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Prospects for measurements of heavy antimatter in space

Research of antimatter heavier than $\bar{p}$ in cosmic rays (CRs) addresses fundamental physics questions, such as the nature of Dark Matter or the existence of primordial antimatter.
Anti-nuclei heavier than $\bar{d}$ are unlikely to be formed during CRs propagation, as confirmed by the PHOENIX and ALICE collaborations. Thus, Dark Matter interactions could lead to the formation of anti-nuclei, especially at low energies ($\leq$ 1 GeV/N).
Experiments dedicated to the research of heavy antimatter must possess high charge sign discrimination due to the matter-antimatter unbalance.

The AMS-02 collaboration has identified about ten anti-He candidates.
Each detector's effect, such as the rigidity resolution and the internal interactions, may lead to misidentifying matter as antimatter, producing a dominant background over rare signal candidates.
I am working on the development of a Monte Carlo simulation to mimic the response of an AMS-02-like detector, identifying several phenomena that misidentify He as anti-He. With the implementation of a fully connected neural network, trained over diverse sources of charge sign confusion, it is possible to quantify the event reconstruction quality.
This tool could reduce the He background for the research for anti-He in CRs.

The PHeSCAMI (Pressurized Helium Scintillating Calorimeter for AntiMatter Identification) project aims to identify anti-D in CRs. A segmented calorimeter of pressurized Helium is used as a target. Helium offers the unique feature of delayed annihilation ($\sim$ μs) for anti-particles stopping inside of it allowing tagging such events.
Furthermore, the topology and the multiplicity of secondaries produced by the annihilation permit us to distinguish between anti-p and anti-D.
The characteristics of a possible high-acceptance detector, to be operated on a circumpolar stratospheric balloon and based on the PHeSCAMI project, are presented.

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