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Updates on the GAPS experiment - a search for light cosmic ray antinuclei

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Currently finalizing its design and beginning its construction, the General Anti Particle Spectrometer (GAPS) is a planned balloon-borne cosmic-ray experiment scheduled for a long duration balloon flight from McMurdo Station in the Antarctic. Its primary science goal is the search for light antinuclei in cosmic rays at energies in the region below 0.25 GeV/n. This energy region is especially of interest and still mostly uncharted.
Searches for light antimatter nucleons with energies below ˜0.25 GeV/n promise a novel approach for the search of dark matter. The large fraction of dark matter models proposes annihilation or decay of the unknown dark matter particle with matter/antimatter pairs in its final state. Positron/electron, as well as antiproton/proton searches, have been conducted. However, due to large uncertainties in the astrophysical backgrounds up to this date the interpetation of the data is still debated. GAPS promises to yield unprecedented sensitivity for the search of antiprotons and especially antideuterons.
To reach the required sensitivity, the GAPS detector incorporates a new approach for antimatter detection, utilizing a time-of-flight system together with a tracker with custom-designed, lithium-drifted silicon wafers. The detector is capable of measuring the beta and dE/dx profiles of particle tracks along with the X-ray cascade expected from antimatter capture in the detector material. The observation of the X-ray cascade from exotic atoms has a large potential for the identification of a golden channel of antideuteron candidates.
Major challenges in detector design and construction, as well as the development of reconstruction algorithms and simulation tools have been mastered by the GAPS collaboration in the last year. This talk will review the current status and the path forward to the first flight from Antarctica in December 2021.

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