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GAPS: Searching for Dark Matter using Antinuclei in Cosmic Rays

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The General Antiparticle Spectrometer (GAPS) is designed specifically to measure low energy (E < 0.25 GeV/nucleon) antinuclei in the cosmic radiation.
Many beyond standard model theories predict a possible signal of antinuclei from dark matter annihilation or decay. In this context, the antideuteron component is particularly interesting because the intensity from secondary/tertiary interactions is expected to be several orders of magnitude lower than the dark matter signal. This represents a background free searches for indirect dark matter measurement.
GAPS will also conduct a low-energy antihelium search and a high precision measurement of low energy antiprotons. Together, these observations will provide a powerful search for dark matter and for primordial black hole evaporation.

GAPS will use a novel particle identification method based on exotic atom formation and
decay, characterized by the emission of pions, protons and atomic X-rays from a common annihilation vertex. This detection technique will give GAPS the high rejection factors necessary for rare antinuclei searches.

The detector consists of a a plastic scintillator
time-of-flight system which surround a tracking system made up of ten planes of lithium-drifted silicon Si(Li) detectors.

The first of a series of a long-duration Antarctic balloon flight is expected for the austral summer of 2020 or 2021. This presentation covers the design, the scientific motivation for the GAPS experiment and its current status.

Collaboration name

GAPS collaboration

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