



Contribution ID: 294

Type: **not specified**

The GAPS Antarctic Balloon Mission: A Dark Matter Search with Cosmic-ray Antinuclei

Monday, 11 September 2023 17:15 (15 minutes)

The General Antiparticle Spectrometer (GAPS) is an upcoming Antarctic balloon mission to search for dark matter by measuring low-energy cosmic-ray antinuclei using a novel detection technique. GAPS is the first experiment optimized to detect cosmic-ray antideuterons below $0.25 \text{ GeV}/n$. Antideuteron production in this energy range is kinematically suppressed in standard astrophysical processes but expected from a wide range of well-motivated dark matter models. Thus, detection of antideuterons by GAPS would be a smoking-gun signature of new physics. In addition to antideuterons, GAPS will also provide a precision cosmic-ray antiproton spectrum in a previously unprobed energy range, as well as leading sensitivity to low-energy antihelium-3. The GAPS sensitivity to antinuclei is enabled by a novel particle identification method based on exotic atom formation, de-excitation, and decay. Exotic atom-based particle identification provides a unique event topology for negatively-charged antinuclei and, because it does not require a magnet, enables a large sensitive area for detecting rare events within the constraints of a balloon payload. The instrument contains two sensitive detector systems. A $\sim 2.5 \text{ m}^3$ tracker volume instrumented with 1060 silicon sensors and cooled by an oscillating heat pipe thermal system serves as the target, X-ray spectrometer, and particle tracker. Completely enclosing the tracker with $\sim 40 \text{ m}^2$ of scintillator panels, the time-of-flight system provides the instrument trigger and the velocity measurement. Calibration and testing of the payload is underway, in preparation for the first of several Antarctic flights expected in 2024. This contribution will briefly review the dark matter motivation for a low-energy cosmic-ray antinucleus detector. It will then introduce the GAPS instrument and its sensitivity to antinuclei before finally reporting the calibration of the detector systems and the performance of the integrated payload.

Primary author: Dr ROGERS, Field (University of California, Berkeley / Space Sciences Laboratory)

Presenter: Dr ROGERS, Field (University of California, Berkeley / Space Sciences Laboratory)

Session Classification: CCR: Charged Cosmic Ray

Track Classification: Charged Cosmic Rays