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The GAPS Instrument and Detection Technique

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The General Antiparticle Spectrometer (GAPS) Antarctic long duration balloon mission is the first experiment optimized for the detection of low-energy cosmic antinuclei. Its novel detection technique is based on exotic atom formation, excitation, and decay, and aims to place world leading limits on viable dark matter models and inform existing models of cosmic ray propagation. There are two primary components of the GAPS instrument, designed to be highly sensitive to the rare events of interest: a large-area silicon tracker and a surrounding time-of-flight system (TOF) with near-100% hermeticity. The combination of these two systems allows GAPS to effectively differentiate between species of negatively-charged antinuclei and determine the energy deposition, velocity, and trajectory of particles interacting with the detector. This talk will briefly review the GAPS detection technique, as well as report on the status of construction of the instrument with a focus on TOF detector hardware progress. In addition, we will discuss the implementation and outcome of the GAPS functional prototype, which was assembled at the MIT Bates Research Center in October of 2021 and will continue taking data through May of 2022.

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