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The GAPS Experiment: An Antarctic Balloon Mission Searching for Dark Matter with Cosmic Antinuclei

Monday 28 August 2023 16:30 (15 minutes)

GAPS is a balloon-borne particle-tracker searching for signals of dark matter from low-energy (kinetic energy ≤ 0.25 GeV/n) cosmic antideuterons. In standard astrophysics, antideuteron production is kinematically suppressed at low energies; consequently, low-energy cosmic antideuterons are a nearly background-free signal of dark matter annihilation or decay. GAPS will make a precision measurement of the antiproton spectrum in a previously-unexplored low-energy range, allowing it to place new constraints on primordial black holes. Finally, GAPS will offer the leading sensitivity to low-energy antihelium-3, a signal of new physics. GAPS will achieve these goals utilizing a novel detection technique based on the formation, deexcitation, and annihilation of exotic atoms. The GAPS instrument has two detecting subsystems: a time-of-flight and a particle tracker. The Time-of-flight is composed of 160 plastic scintilator paddles and their custom read-out electronics. The tracker consists of $\sim$ 1000 lithium-drifted silicon detectors which are read out with custom ASICs. The experiment is being integrated and undergoing calibration and testing, in advance of its first Antarctic long-duration balloon flight in the austral summer of 2024. This presentation will review the science motivation for antideuteron searches for dark matter, describe the GAPS experiment, and report the status of the GAPS instrument along with results from our ground testing.

Submitted on behalf of a Collaboration?

Yes

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