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Indirect search for dark matter with cosmic-ray antinuclei: the GAPS experiment

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The General Antiparticle Spectrometer (GAPS) is a balloon-borne experiment designed to perform low-energy cosmic-ray antinuclei measurements searching for indirect signatures of dark matter annihilation or decay. A wide range of well-motivated dark matter models predicts antinuclei fluxes about two orders of magnitude above the expected astrophysical background below 250 MeV/n. The coverage of this unexplored low-energy region allows GAPS to achieve an unprecedented sensitivity for antideuteron and antihelium nuclei fluxes. GAPS will collect extensive statistics of low-energy antiprotons, extending the measurement of the antiproton spectrum to the unexplored region below 100 MeV. The GAPS experiment will perform three long-duration balloon flights over Antarctica, the first of which is planned for the 2024/2025 Austral summer. The experimental apparatus consists of a Si(Li) tracker surrounded by a time-of-flight system made of plastic scintillator paddles. GAPS uses a novel identification technique based on the formation of an exotic atom and its de-excitation and decay. This contribution will first illustrate the scientific potential of the GAPS experiment and its impact on indirect dark matter searches. It will then describe the experimental apparatus and the detection technique exploited to identify antinuclei events. The expected sensitivity for antinuclei, based on detailed instrument simulations, will be then discussed. Finally, the payload integration and the results of the system's ground tests will be summarized.

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