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Search for Dark Matter using Low-energy Antimatter with the GAPS experiment

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The GAPS experiment will be designed to carry out dark matter studies by searching for low-energy cosmic-ray antiparticles (in particular antideuterons).

The antideuteron flux, resulting from secondary interactions of primary cosmic rays with the interstellar medium, is very low; novel theoretical studies beyond the standard model of particle physics (i. e., SUSY etc.) predict dark matter candidates, which could lead to a significant enhancement of the antideuteron flux, mostly at low energy ranges.

The detector will consist of a series of Si(Li) planes of solid state detectors and a time of flight system.

Low-energy (< 300 MeV/n) antideuterons will be slowed down in the Si(Li) material, forming an excited exotic atom that will create a characteristic annihilation pion star after de-excitation processes through X-ray transitions. This unique signature will be crucial for a nearly background-free event detection.

The GAPS experiment is designed to utilize a series of long-duration balloon flights from Antarctica, and is currently scheduled by NASA for its first Antarctic flight in late 2020.

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