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Antideuteron Signatures of Dark Matter with the GAPS Experiment

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Recent years have seen increased theoretical and experimental effort towards the first-ever detection of cosmic-ray antideuterons, in particular as an indirect signature of dark matter annihilation or decay in the Galactic halo. In contrast to other indirect detection signatures, which have been hampered by the large and uncertain background rates from conventional astrophysical processes, low-energy antideuterons provide an essentially background-free signature of dark matter. This signal probes a broad class of dark matter candidates and is particularly sensitive to low-mass WIMP dark matter, both complementing current experiments and offereing a potential breakthrough in unexplored dark matter phase space. In this contributuion, I will present the theoretical motivation for dark matter searches with antideuterons and the dominant theoretical uncertainties associated with antideuteron flux predictions, specifically nuclear formation and cosmic-ray propagation in the Galactic and Solar environments. I will then introduce the currently planned or ongoing experiments that will be sensitive to the flux levels predicted for dark matter, focusing on the baloon-borne GAPS experiment, which exploits a novel detection technique utilizing exotic atom capture and decay to provide both a sensitive antideuteron search and a precision antiproton measurement in an unprecedented low-energy range.

Oral or Poster Presentation

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