

An Helium calorimeter for Anti-Deuteron identification in cosmic rays.

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Low energy anti-deuterons in cosmic rays are considered a golden channel for the search of Dark matter annihilations in the galaxy. Anti Deuteron Helium Detector (ADHD) project is aiming to study the signatures offered by an high pressure Helium target for the identification of anti-deuterons in cosmic rays.

In particular exotic atoms are produced by stopping anti-protons/anti-deuterons in the gas and the captured particle can orbit the Helium nucleus for microseconds before the annihilation.

This meta-stability is a unique feature for the Helium target and the characteristic delayed annihilation is a distinctive signature to identify the antimatter nature of the stopping particle.

A possible configuration for ADHD space/balloon detector consists of a pressurized helium calorimeter surrounded by scintillator layers for velocity measurement.

Anti-deuterons are identified by combining the spectrometric measurement of the stopping particle (velocity/energy) with the delayed emission of outgoing charged pions caused by the annihilation.

A prototype of the pressurized calorimeter, filled by 200 Bar Helium acting as a scintillator, has been characterized with cosmic muons and with 70-240 MeV proton beam in the INFN-TIFPA laboratory.

Sensitivity of the possible Anti-Deuteron-Helium-Detector for the measurement of low energy anti-deuterons and anti-protons in cosmic rays will be summarized and the results of the measured performance of the helium calorimeter prototype will be addressed.