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Indirect Dark Matter Search with CALET

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The ISS-based CALET (Calorimetric Electron Telescope) detector is directly measuring the energy spectrum of electron+positron cosmic rays up to 20 TeV with an expected energy resolution of 2%. With an estimated proton rejection capability of $1 : 10^5$ and an aperture of approximately 1200 cm^2 sr, it will provide good statistics even well above one TeV. This precise spectrum is going to be analysed for signatures from nearby astrophysical sources such as pulsars and supernova remnants (SNR), as well as from Dark Matter annihilation and decay.
Pulsars and Dark Matter are candidates for the postulated extra source emitting an equal amount of electrons and positrons that is regarded as the origin of the positron excess.
Assuming a single pulsar is the extra source, the limits on a potential additional component from Dark Matter annihilation in the galactic halo expected to be obtained from 5 years of CALET observation are presented. It is shown that CALET could significantly improve upon current limits, especially for Dark Matter candidates with a large fraction of annihilation directly into electron+positron, such as the LKP (Lightest Kaluza-Klein particle).
As a possible case of a Dark Matter only explanation of the positron excess, Dark Matter decaying in a 3-particle leptonic mode was studied, as it is not constrained by anti-proton measurements and multiple theories predict suitable Dark Matter candidates. Based on the expected signal and background in CALET, the potential to discern the signatures of this decay from a pulsar being the extra source is shown.
The influence of a nearby SNR as an additional spectrum component in the TeV region and the prospects of using anisotropy in identification of the cosmic rays' origin are discussed as well.

Summary

The CALET detector is directly measuring the electron+positron cosmic ray spectrum up to 20 TeV with high precision. This measurement is going to be analysed for nearby astrophysical sources, as well as from Dark Matter annihilation and decay. Based on simulation of the expected CALET data, it is shown that it will allow for significant improvement upon current limits on Dark Matter annihilation, and discerning several possible Dark Matter explanations of the positron excess from the nearby pulsar explanation.

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