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CALET's Sensitivity to Dark Matter and Astrophysical Sources

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The Calorimetric Electron Telescope (CALET) will be launched to the ISS within this year and measure the energy and direction distribution of electron+positron cosmic rays well into the TeV range during a 5 year mission. With a $1{:}10^5$ proton rejection rate and an energy resolution of 2%, it is capable of detecting even small features in the spectrum. Combining the measurement of the total electron and positron flux by CALET with the positron fraction data from the AMS-02 experiment, it will be possible to significantly constrain models of Dark Matter annihilating in the galactic halo. Assuming the positron excess is caused by a single power law source, the expected Dark Matter limits for the year 2021 will be presented, based on simulated data for the 5 year CALET mission together with positron fraction data for by then 10 years of AMS-02 measurement, extrapolated from their latest published results. These predictions are compared to limits derived with the same procedure using current experimental data from AMS-02 and Fermi-LAT.
While emission from a single nearby pulsar wind nebula is a possible explanation for the positron excess, the large number of pulsars discovered by radio and X-ray telescopes makes an overlapping spectrum from several strongly contributing sources likely. Based on a numerical cosmic ray propagation simulation, the cosmic-ray spectra from nearby pulsar wind nebulae have been calculated and the expected capability of CALET to discern the multiple overlapping spectra, with parameters chosen to explain the observed cosmic ray excess, from the single power law spectrum of one pulsar is shown.

Collaboration

CALET

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Author: Dr MOTZ, Holger (Waseda University)

Presenter: Dr MOTZ, Holger (Waseda University)

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