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Self Consistent Simulation of Dark Matter Annihilation And Background

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Future space based experiments such as CALET and DAMPE will measure the electron and positron cosmic-ray spectrum with better energy resolution and up to higher energy, making detection of small features in the spectrum, which might originate from Dark Matter annihilation or decay in the galactic halo, possible. For precise prediction of these features, the numerical cosmic ray propagation code GALPROP is used, and was extended to calculate the flux at Earth from different Dark Matter scenarios with any given injection spectrum. The results from GALPROP for both the cosmic-ray background spectrum and the component from Dark Matter annihilation are strongly dependent on the bin size in energy used in the calculation, due to energy loss playing a major role in the propagation of electrons. A modification to partly compensate the influence of the discretization of the energy shifted particles has been implemented in the code. The effect of this improvement is demonstrated with examples of the expected spectra for the cosmic ray background in combination with several Dark Matter candidates calculated at different energy binning.

http://www.crlab.wise.sci.waseda.ac.jp/eng/wp-content/uploads/downloads/2015/03/icrc.png

This figure shows the background electron flux is subjected to a shift in power law index due to finite energy bin size, as shown by the difference between the results for calculation with a bin size of 4% (magneta line), and 30% (orange dots)of the energy. In the result for the modified code (green dots) the change is compensated, giving results matching the finer energy binning. The AMS-02 results and a possible Dark Matter Contribution(electron+positron channel,Mass of DM=400GeV, Boost Factor=130) are shown in maroon and grey respectively.

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Author: BHATTACHARYYA, Saptashwa (Waseda University)

Co-authors: Dr MOTZ, Holger (Waseda University); TORII, Shoji (Waseda University (JP)); ASAOKA, Yoichi (Waseda University (JP)); Ms OKADA, Yuko (Waseda University)

Presenter: BHATTACHARYYA, Saptashwa (Waseda University)

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