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New cosmic ray MIN-MED-MAX benchmark models for dark matter indirect signatures

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Galactic charged cosmic rays, notably positrons, antiprotons and light antinuclei, are powerful probes of dark matter annihilation or decay, in particular for candidates heavier than a few MeV or tiny evaporating primordial black holes. Recent measurements by PAMELA, AMS-02, or Voyager on positrons and antiprotons already translate into constraints on several models over a large mass range. However, these constraints depend on galactic transport models, in particular the diffusive halo size L, subject to theoretical and statistical uncertainties.

I will first discuss the new constraints which we have set on L as reported in A&A 639 (2020) A74. Using Be/B data on top of the secondary-to-primary ratios Li/C and B/C, we derive an average value of $L = 5^{+3}_{-2}$ kpc at 1σ. These constraints improve by a factor of 2 when low-energy 10Be/9Be data are included.

Using these results, we have updated, in a comprehensive analysis soon to be released, the so-called MIN-MED-MAX benchmark transport parameters that yield generic minimal, median, and maximal dark matter produced fluxes. I will discuss how we have defined these benchmark configurations from a selection of models based on the diffusive halo height L and on a specific low-energy transport parameter that depends on the cosmic ray transport scheme. I will illustrate our results with a 100 GeV dark matter species annihilating into bb quark or electron-positron pairs, and present the positron and antiproton fluxes that this particle generates at the Earth. With our revised MIN-MED-MAX sets, the uncertainties on primary fluxes improve by a factor of 3-4 (positrons) and 7 (antiprotons) with respect to their former version.

Keywords

Galactic transport; dark matter indirect signatures; antimatter cosmic rays; benchmark for indirect signals

Collaboration

other Collaboration

Cosmic Ray Alpine Collaboration (CRAC)

Subcategory

Theoretical Results

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