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Cosmic-ray combined analyses to shed light in the antiproton excess and its possible dark matter origin

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Recent cosmic-ray (CR) antiproton studies have claimed the possibility of an excess of data over the predicted flux at around 10 GeV, which can be the signature of dark matter annihilating into antiprotons. Nevertheless, this excess is subject to many uncertainties related to the evaluation of the antiproton spectrum produced from spallation interactions of CRs.

We implement a combined Markov chain Monte Carlo analysis of the secondary-to-primary ratios of B, Be and Li and the antiproton-to-proton spectrum (ap/p), also including nuisance parameters to consider the uncertainties related to the spallation cross sections (nuclear uncertainties). This analysis allows us to constrain the Galactic halo size and the rest of propagation parameters, evaluate the impact of the nuclear uncertainties in the determination of the antiproton spectrum and test the excess of antiprotons. We show that our predictions turn out to be compatible with the AMS-02 data, within the uncertainties related to the prediction of the antiproton spectrum from CR collisions. Nevertheless, we find that there is still an excess of ap/p data over our prediction, although this has a slightly different morphology with respect to that previously reported, due to the additional constraints on the diffusion coefficient that we include. Indeed, this leads to a possible signal of a WIMP of mass a factor 2 greater than that usually quoted and a thermal-averaged cross section of 3-10 times greater than previous studies claim.

Keywords

Dark matter indirect search; cosmic-ray antiprotons; cosmic ray diffusion

Collaboration

other Collaboration

Subcategory

Theoretical Results

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