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Uncertainties on propagation parameters: impact on the interpretation of the positron fraction

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The positron fraction in cosmic rays has recently been measured with improved accuracy up to 500 GeV, and it was found to be a steadily increasing function of energy above ~ 10 GeV. This behaviour contrasts with standard

astrophysical mechanisms, in which positrons are secondary particles, produced in the interactions of primary cosmic rays during

their propagation in the interstellar medium. The observed anomaly in the positron fraction triggered a lot of excitement, as

it could be interpreted as an indirect signature of the presence of dark matter species in the Galaxy, the so-called weakly interacting massive particles (WIMPs). Alternatively, it could be produced by nearby sources, such as pulsars.

These hypotheses are probed in light of the latest AMS-02 positron fraction measurements. The cosmic ray positron transport in the Galaxy is described using a semi-analytic two-zone model. For consistency, the secondary and primary components of the positron flux are calculated together with the same propagation model. We show that the results inferred for both hypotheses crucially depend on the propagation parameters, estimated with the Boron-to-Carbon ratio. Their uncertainties turn out to be very significant, and overshadow even the statistical errors from the positron data.

Collaboration

– not specified –

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