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Constraining dark matter annihilation with cosmic-ray antiprotons using neural networks

Tuesday 23 November 2021 16:00 (15 minutes)

The derivation of indirect constraints on dark matter annihilation in our Galaxy from cosmic-ray antiprotons requires computationally expensive simulations of cosmic-ray propagation. I will present a new method based on Recurrent Neural Networks that significantly accelerates simulations of cosmic-ray antiproton spectra from secondaries and dark matter and achieves an excellent accuracy. Importance sampling is identified as particularly suitable for efficiently marginalizing over the nuisance parameters related to cosmic-ray propagation while ensuring that the networks are only evaluated in well-trained parameter regions. The method allows to investigate a wide range of dark matter models and it speeds up the runtime by at least two orders of magnitude compared to conventional approaches. I will illustrate our method on two examples: First, for a generic dark matter model annihilating into a pair of $b\bar{b}$-quarks and and, second, for the scalar singlet dark matter model.

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