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Nailing down the theoretical uncertainties of $\bar{D}$ spectrum produced from dark matter

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The detection of cosmic antideuterons at kinetic energies below a few GeV/n could provide a smoking gun signature for dark matter (DM). However, the theoretical uncertainties arising from the choice of coalescence models were so far one of the main limiting factors for precise predictions of the $\overline{\mathrm{D}}$ flux. In this talk, we present a novel calculation of the $\overline{\mathrm{D}}$ source spectra, based on the Wigner formalism, for which the Argonne wave function has been used. A remarkable feature of this formalism is that it excellently agree with the ALEPH measurement of $\overline{\mathrm{D}}$ although it does not contain any free parameters. The analysis is based on state-of-art tools for Monte Carlo event generation including full spin correlations, off-shell effects, and all the electroweak and Higgs triple and quartic interactions in the showering process. The theoretical uncertainties due to the choice of the coalescence model is of order of a few percent for $\overline{\mathrm{D}}$ kinetic energies relevant to DM searches with GAPS and AMS, and for DM masses above a few tens of GeV. We provide the tabulated source spectra for all the relevant DM annihilation/decay channels and DM masses between 5 GeV and 100 TeV, on this GitHub repository: https://github.com/ajueid/CosmiXs.git.
Based on:
https://arxiv.org/abs/2411.04815
https://arxiv.org/abs/2312.01153

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