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Antinuclei as a Signature of Dark Matter

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Light antinuclei may be generated in dark matter annihilations or decays, offering a potential method of identifying the nature of dark matter. However, current estimations of the antinucleus fluxes has large uncertainties due to, amongst other, the antinucleon formation models. Today it is common to use the coalescence model on an event-by-event basis in a Monte Carlo framework when estimating the antinucleus production in both various dark matter models and the astrophysical background. However, this model is classical and lacks a microphysical picture. We therefore develop a new coalescence model for deuteron, helium-3, tritium and their antinuclei based on the Wigner function representations of the produced nuclei states. This approach includes both the size of the formation region, which is process dependent, and momentum correlations in a semi-classical picture. We compare the predictions of this model with experimental data from e^+e^- collisions at LEP and pp collisions at LHC and find in general good agreement with the data. Finally, we comment on the detection prospects of cosmic ray antideuteron and antihelium.

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