

CosmiXs: Cosmic messenger spectra for indirect dark matter searches

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The energy spectra of particles produced from dark matter (DM) annihilation or decay are one of the fundamental ingredients to calculate the predicted fluxes of cosmic rays and radiation used for indirect DM detection. We revisit the calculation of the source spectra for annihilating and decaying DM employing the Vincia shower algorithm in Pythia to include QED and QCD final state radiation and diagrams for the electroweak corrections with massive bosons, not present in the default Pythia shower model. We take into account the spin information of the particles during the entire electroweak shower and the off-shell contributions from massive gauge bosons. Furthermore, we perform a dedicated tuning of the Vincia and Pythia parameters to LEP data on the production of pions, photons, and hyperons at the resonance and discuss the underlying uncertainties. To enable the use of our results in DM studies, we provide the tabulated source spectra for the most relevant cosmic messenger particles, namely antiprotons, positrons, gamma rays and the three neutrino flavours, for all the fermionic and bosonic channels and DM masses between 5 GeV and 100 TeV, on GitHub (<https://github.com/ajueid/CosmiXs.git>).

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