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Studying dark matter with MadDM: Lines and loops

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Automated tools for the computation of amplitudes and cross sections have become the backbone of phenomenological studies beyond the standard model. We present the latest developments in MadDM, a calculator of dark matter observables based on MadGraph5_aMC@NLO. The new version enables the fully automated computation of loop-induced annihilation processes, relevant for indirect detection of dark matter. Of particular interest is the electroweak annihilation into γX, where $X = \gamma$, Z, h or any new unstable particle even under the dark symmetry. These processes lead to the sharp spectral feature of monochromatic gamma lines: a smoking-gun signature for dark matter annihilation in our Galaxy. MadDM provides the predictions for the respective fluxes near Earth and derives constraints from the γ-ray line searches by Fermi-LAT and HESS. As an application, we present the implications for the parameter space of the Inert Doublet model and a top-philic t-channel mediator model.

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