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Dark matter indirect detection limits from complete annihilation patterns

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Numerous studies have led to upper limits on the dark matter annihilation cross-section assuming only single exclusive annihilation channels. We consider a more realistic situation and present a study taking into account the complete annihilation pattern within a given particle physics model. This allows us to study the impact on the derived upper limits on the dark matter annihilation cross-section from a full annihilation pattern compared to the case of a single annihilation channel. We use mockdata for the Cherenkov Telescope Array simulating the observations of the promising dwarf spheroidal galaxy Sculptor. We show the impact of considering the full annihilation pattern within a simple framework where the Standard Model of particle physics is extended by a singlet scalar. Such a model shows new features in the shape of the predicted upper limit which reaches a value of $\langle\sigma v\rangle$=3.8×10−24 cm−3s−1 for a dark matter mass of 1 TeV at 95% confidence level. Based on our study, we recommend to consider the complete particle physics information in order to derive more realistic limits.

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