

Light thermal dark matter and MeV gamma-ray detection

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In response to the negative result of experiments searching for the WIMP, the light thermal DM is getting more and more attention. Considerable efforts are being dedicated to the search for light DM, with indirect detection emerging as a rapidly advancing field. The light thermal DM is expected to produce gamma rays in the MeV energy region from its annihilation, though it was known that detecting MeV gamma rays is challenging compared to those in different energy regions. However, advancements in technology and theoretical studies have opened up possibilities to detect MeV gamma rays efficiently, leading to the approval of the Compton Spectrometer and Imager (COSI). We comprehensively and quantitatively investigate the phenomenology of the light thermal DM to explore whether the COSI observation can prove their viable model parameter regions. We found that such parameter regions exist, predicting velocity-dependent annihilation cross-sections via several distinct mechanisms, such as annihilation via a forbidden channel and an s-channel resonance, and those are potentially detectable by the COSI via both continuum and line gamma-ray observations.

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