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Light thermal dark matter and MeV gamma-ray observation

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Light thermal dark matter, whose mass is below 1GeV, is an attractive candidate for dark matter, as its abundance in the present universe is well explained by the thermal freeze-out mechanism. At the same time, it may solve the so-called core-cusp problem via its strong enough self-scattering. We study a minimal model for a light scalar dark matter as an example of such a candidate, requiring a light scalar mediator to address the core-cusp problem and interact with the standard model particles. We analyze the model comprehensively by focusing on the Breit-Wigner resonance for dark matter annihilation and self-scattering channels, considering the thermal relic abundance condition that includes the early kinetic decoupling effect, as well as the present and future constraints from collider, direct, and indirect dark matter detections. We found that the scalar dark matter with a mass of 0.3-2 GeV remains uncharted, which will be efficiently tested by the near future MeV gamma-ray observations.

Author: Dr MATSUMOTO, Shigeki (Kavli IPMU)

Presenter: Dr MATSUMOTO, Shigeki (Kavli IPMU)

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