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Observational Properties of Feebly Coupled Dark Matter

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Can dark matter properties be constrained or detected if dark matter particles do not interact with the Standard Model fields? The answer is yes. By studying both cosmological and astrophysical constraints, we show that stringent constraints on dark matter particle mass and coupling values can be derived even if the dark matter sector is uncoupled from the Standard Model sector.

By taking the Higgs portal model as a representative example, we compute the total dark matter abundance from decay of a primordial dark matter condensate and nonthermal production from the Standard Model sector. We then use the Planck limit on isocurvature perturbations and different astrophysical constraints on dark matter properties to derive a novel constraint connecting dark matter particle mass and self-interaction coupling with the scale of cosmic inflation.

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