Title:	WIMP Decay as possible WDM Model
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Keywords:	WIMP Decay WDM Model
Issue Date:	May-2023
Publisher:	IISER Mohali
Abstract:	Approximately 83% of the universe's entire mass is made up of dark matter. If baryons, which constitute only 17%, offer such a rich variety of physical phenomena, one can only imagine the wealth of fascinating physics that remains to be discovered by exploring the origin of dark matter. Weakly Interacting Massive Particles (WIMPs) have long been the favoured candidate under ΛCDM model. However, in view of the lack of experimental confirmation of WIMPs and structure formation discrepancies in CDM simulations, we are motivated to consider the decay of WIMPs into warm dark matter (WDM) particles and radiation. We present a non-thermal model, solely characterized by the mass to momentum ratio r of the WDM particle. We formulate the linear perturbation theory pertaining to this model and the re- sulting matter power spectrum indeed shows suppression at small scales. To investigate the viability of this model, we have used the data-sets of (i) Temperature, polarisation, lensing correlations from Planck 2018 CMB (ii) Baryon acoustic oscillation (BAO) signal in lu- minous red galaxy distribution from SDSS(BOSS). These observables constrain our model parameters: r ≥ 1.192 × 10 6 , k FS ≥ 0.92 h Mpc −1 , σ ≥ 2.83 × 10 −48 m 2 , m ≥ 2.8 keV. The lack of an upper bound suggests that for large scale structural datasets of CMB and BAO, CDM and WDM (r ≥ 1.192 × 10 6) models work equally well. To further test our model at smaller scales, we turn to Press-Schechter formalism to study the evolution of collapsed DM fraction in haloes. Probing it with neutral hydrogen density from SDSS Lymanα data provides consistent constraints: r > 10 6 , but the error bars are too large to compute any stronger bounds. Nevertheless, the suppressed power spectrum pertaining to the WDM model consistent with these bounds might potentially resolve a number of structure forma- tion discrepancies of the ΛCDM model. Additionally, this decay model can salvage the WIMP theory in case of a non-detection by expanding mass-cross section parameter space for DM searches, while also opening up new avenues in terms of observables like possible decay radiation.
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URI:	http://hdl.handle.net/123456789/5396
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