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The Impact on Dark Matter Abundances from an Early Kinetic Decoupling

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Abstract content

The standard way to calculate the thermal relic abundance of dark matter relies on the assumption that the dark matter particles remain in kinetic equilibrium throughout the chemical freeze-out process. However, this assumption is not always justified. This talk aims to address how to handle such situations, i.e. when an early kinetic decoupling happens, and discuss the phenomenological consequences. Two approaches are explored: One that combines higher momentum moments of the underlying Boltzmann equation and the other is to numerically find the evolution of the full phase-space distribution of the dark matter particles. The implications are illustrated for the case of the Scalar Singlet model, which is often referred to as the simplest WIMP model. In this model, it can be explicitly shown that the predictions of the dark matter abundance can be altered by up to an order of magnitude.

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