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Distinguishing the thermal history from structure formation

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Structure formation has been used as a means to constrain the velocities of dark matter particles. For some typical models, such constraints are converted as constraints on dark-matter mass.
In this work, we explore the implications of these constraints on the thermal history of dark matter.
We find that they can constrain the decoupling temperatures in both the SM sector and the dark sector, but the constraints differ significantly between different scenarios such as relativistic/non-relativistic freeze-out, and freeze-in.
We also show that, given a model assumption, complementary information from different observations can help us determine the thermal history of dark matter.

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