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Dark matter distribution, structure formation and the potential to distinguish thermal histories of dark matter.

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It is important to understand the implications of current observational constraints and potential signatures on the thermal history of dark matter. Using the freeze-in/-out scenarios as templates, we revisit dark-matter production by solving the Boltzmann equations at the level of the phase-space distribution. We also investigate the current Lyman-alpha constraints on mass of the dark matter and build the connection between the mass and the production mechanism of dark matter and find that the current observation on structure formation can be imposed to constrain the decoupling temperatures and the phase-space distribution of dark matter. We further explore the potential of distinguishing different possible thermal histories of dark matter with hypothetical future observational data. This method can be more generally applied to other scenarios.

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