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Thermal Dark Matter production in non-standard cosmologies

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The nature and origin of dark matter (DM) remain open questions in modern physics. Dark matter production is commonly studied assuming a standard radiation-dominated cosmology before Big Bang Nucleosynthesis. In this work, we investigate DM production through freeze-out and freeze-in in non-standard cosmological scenarios that modify the expansion and thermal history of the early Universe. We identify regions of parameter space compatible with the observed relic density, $\Omega_{\rm DM}h^2 = 0.120$. Our results show that a non-standard reheating period can significantly modify the viable parameter space, allowing scenarios strongly constrained in standard cosmology to become compatible with the observed DM abundance.

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