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Phasing-in dark matter

Tuesday, July 22, 2025 4:00 PM (20 minutes)

Despite being an elegant mechanism to explain Dark Matter (DM) production, freeze-in introduces challenges: If DM interacts via non-renormalizable operators, the predictions are highly sensitive to initial conditions, such as the reheating temperature of the universe. These issues are particularly relevant in models in which the universe deviates from radiation domination and the entropy of the Standard Model (SM) thermal bath is not conserved.

In this talk, I will present a general freeze-in scenario in which a scalar field dominates the energy density of the universe before undergoing a first-order phase transition and then slowly decaying to visible particles. The decays lead to a second phase of reheating of the radiation bath and to additional contributions to DM freeze-in. I will explore the conditions under which these late contributions dominate over the initial DM abundance produced at primordial reheating. In this scenario, referred to as \textit{phase-in}, the final abundance of DM is primarily determined by the details of the phase transition and subsequent reheating, and insensitive to the details of inflationary reheating.

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