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Minimal FIMP models during reheating and inflationary constraints

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We study the production of Dark Matter (DM) in a minimal freeze-in model during inflationary reheating. We analyze the case where a heavier parent particle decays into DM and a Standard Model fermion in two reheating scenarios: bosonic reheating (BR) and fermionic reheating (FR). Firstly, we show that for low reheating temperatures, BR and FR scenarios predict different lifetimes and masses for the parent particle when considering reheating potentials with power-law behavior. Additionally, we highlight how different treatments of the reheating phase and definitions of the reheating temperature in the literature can lead to conflicting conclusions about the relevance of long-lived particle (LLP) searches in testing the freeze-in model. Moreover, we investigate the interplay between LLP searches and cosmological constraints on SUGRA-motivated inflationary models, specifically α -attractor E- and T-models. In essence, we find that the inflaton potential and the reheating temperature significantly affect the relic density of DM and could have crucial implications for interpreting collider signatures and understanding the dynamics of inflationary reheating.

Primary authors: Mr COPELLO, Emanuele (JGU Mainz); Mr LANG, Jonas (TUM); Prof. HARZ, Julia (JGU Mainz); Dr BECKER, Mathias (JGU Mainz); Dr XU, Yong (JGU Mainz)

Presenter: Mr COPELLO, Emanuele (JGU Mainz)

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