

Freeze-in at stronger coupling and the highest temperature in the Universe

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When the Dark Matter (DM) mass is higher than the maximal temperature of the thermal bath, DM can be produced via the freeze-in mechanism with coupling as high as $O(1)$. This leads to an observationally attractive scenario compared to the standard freeze-in couplings that are $O(10^{-10})$. In fact, it can be probed by direct detection experiments and at LHC.

We display this mechanism in the scalar DM case. We then present a UV-completed framework where the maximal SM temperature coincides with or is approximately the reheating temperature. We exemplify this in the case of the inflaton primarily decaying into feebly interacting right-handed neutrinos.

Presenter: COSTA, Francesco