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Freeze-In Dark Matter through Neutrino Portal with an Early Matter Era

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Dark Matter is an important direction for pursuing physics beyond the Standard Model. There are already various experiments searching for the Dark Matter. However, for the Freeze-In Dark Matter, due to the extremely tiny coupling between the dark matter and SM particles, there will be no sensitivity for the DM experiments. On the other hand, we actually have no direct evidence for the evolution of the Universe before BBN/CMB. This provides the possibility that we can add an early matter dominant era, which will also change the accumulation of the Freeze-In dark matter. We investigate such case in a neutrino portal dark matter model, and find that in order to overcome the faster expansion during the EMD as well as the dilution induced from the entropy production, larger coupling between DM and the SM particles is needed which also leads to detectable signal in DM experiments.

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