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WIMPs during reheating

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Weakly Interacting Massive Particles (WIMPs) are among the best-motivated dark matter candidates. In the standard scenario where the freeze-out happens well after the end of inflationary reheating, they are in tension with severe experimental constraints. Here, we investigate the thermal freeze-out of WIMPs occurring during reheating, while the inflaton ϕ coherently oscillates in a generic potential $\propto \phi^n$. Depending on the value of n and the spin of the inflaton decay products, the evolution of the radiation and inflaton energy densities can show distinct features, therefore, having a considerable impact on the freeze-out behavior of WIMPs. As a result of the injection of entropy during reheating, the parameter space compatible with the observed DM relic abundance is enlarged. In particular, the WIMP thermally averaged annihilation cross-section can be several magnitudes lower than that in the standard case. Finally, we discuss the current bounds from dark matter indirect detection experiments and explore future challenges and opportunities.

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