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Freeze-in of WIMP dark matter

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We propose a novel scenario for dark matter (DM) in which weakly interacting massive particles (WIMPs) can freeze-in due to a first-order phase transition (FOPT) in the early Universe. The FOPT dilutes the preexisting DM density to zero, and leads to a sudden change in DM mass that prevents WIMPs from re-equilibrating due to their large mass-to-temperature ratio. Following the FOPT, WIMPs are produced via a freeze-in process, even though their interactions are NOT feeble. We demonstrate this concept using a simplified model and then realize the scenario in a realistic model with a delayed electroweak phase transition. Our work extends the category of WIMP DM and opens up a new direction for the freeze-in mechanism.

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