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Freeze-in: Problems and Opportunities

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FIMP dark matter is produced via the freeze-in mechanism that generally implies tiny couplings between the Dark Matter (DM) and the Standard Model particles, making DM direct detection hopeless. When the interaction is non-renormalizable the coupling is automatically suppressed by the scale of new physics and the production depends strongly on the reheating temperature. A natural candidate, in this case, is a spin $3/2$ DM since it only couples to the Standard Model via dimension 5 or higher operators. We notice that given the standard mass range for DM (few keV - TeV) the reheating temperature (TR) needed for this particle to be the DM is also in the GeV - TeV range. Finally, we show that when TR is comparable to the DM mass direct detection and collider bounds play a fundamental role in constraining the parameter space. We show the viability of the model and discuss the details of the production mechanism and future experiments that can falsify it.

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