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Boosting sterile neutrino dark matter production with self-interactions

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Sterile neutrinos are a well-motivated and simple dark matter (DM) candidate. However, sterile neutrino DM produced through oscillations by the Dodelson-Widrow mechanism are in tension with current X -ray observations. To preserve the attractive features of this scenario, self-interactions among sterile neutrinos have been proposed as a minimal extension of the production mechanism. In this work, we analyze how sterile neutrino self-interactions mediated by a scalar affect the production of keV sterile neutrinos for a wide range of mediator masses. We find that there are four distinct regimes of production characterized by different phenomena, including partial thermalization for low and intermediate masses and resonant production for heavier mediators. We show that significant new regions of parameter space become available for mediator masses up to 1.5 GeV.

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