



Contribution ID: 92

Type: **Parallel Talk**

Boosting the production of sterile neutrino dark matter with self-interactions

Friday 14 June 2024 12:40 (20 minutes)

Sterile neutrinos are well-motivated and simple dark matter (DM) candidates. However, sterile neutrino DM produced through oscillations by the Dodelson-Widrow mechanism is excluded by current X-ray observations and bounds from structure formation. One minimal extension, that preserves the attractive features of this scenario, is self-interactions among sterile neutrinos. 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 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 which provide a target for future observations.

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Session Classification: Joint Session: Flavour/Neutrinos/Dark Matter

Track Classification: Dark matter, astroparticles and gravitational waves