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Cosmological Constraints and Detection Prospects for Sub-MeV Dark Matter

Sub-MeV dark matter remains relatively unconstrained by direct detection, and several well-motivated candidates in this mass range have aroused great interest. Electron recoil experiments have been proposed as a technique to detect such a light particle, but little is known about the extent of cosmological restrictions on a light species coupled to electrons. We perform a systematic study of cosmological constraints on a light dark matter particle coupled to electrons by one of a comprehensive set of effective operators, which approximate a broad class of models with a heavy mediator. Specifically, we study constraints from primordial nucleosynthesis, the dark matter relic abundance, and the effective number of neutrino species (N_{eff}) at CMB formation. We demonstrate the implications of our results for proposed electron recoil experiments, and highlight the regions of parameter space which may be amenable to direct detection.

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