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Status of GeV-scale LLPs

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In this talk, I explore the search for feebly interacting new physics particles (FIPs) in the GeV mass range from a theoretical perspective. I begin by emphasizing the complementarity between astrophysical and cosmological probes in exploring the FIP parameter space. I then survey the landscape of intensity frontier experiments designed to detect FIPs, addressing the principal challenge - theoretical uncertainties in FIP phenomenology, which can substantially influence experimental constraints and sensitivities. Regarding the cosmological probes, I discuss the impact of FIPs on BBN and CMB, focusing on the epoch around neutrino decoupling, a critical period at the edge of current observational capabilities. Special attention is given to recent advances in our understanding of how primordial neutrinos are affected by FIP decays into high-energy neutrinos and metastable particles, such as pions and kaons.

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