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Cosmological Probes of Dark Radiation from Neutrino Mixing

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Models of cosmology including dark radiation (DR) have garnered recent interest, due in part to their versatility in modifying the ΛCDM concordance model in hopes of resolving observational tensions. Equally interesting is the capacity for DR models to be constrained or detected with current and near-term cosmological data. Finally, DR models have the potential to be embedded into specific microphysical models of BSM physics with clear particle physics origins. With these three features of DR in mind, we explore the detailed dynamics for a class of DR models that thermalize after big-bang nucleosynthesis by mixing with the standard model (SM) neutrinos. Such models were proposed in previous work (2301.10792), where only background quantities were studied, and the main focus was on the large viable parameter space. Concentrating on a sub-class of these models with a mass threshold within the dark sector, motivated by the successes of such models for resolving the Hubble tension, we perform a detailed MCMC analysis to derive constraints from CMB, BAO, and Supernovae data. In this talk, I will comment on (i) the degree to which interactions/mixing of DR with SM neutrinos is constrained by current data, (ii) the prospect of the model to resolve the Hubble tension, and (iii) the relevance of this type of self-interacting dark neutrino for explaining anomalies in neutrino experiments.

Mini Symposia (Invited Talks Only)

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