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Light Stepped Dark Sectors Face Cosmological Data Sets

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Light dark relativistic sectors may undergo changes in the number of their relativistic species during the cosmological history (due e.g. to mass thresholds and/or phase transitions), similarly to the visible sector. When such changes occur around recombination, the stringent bound on the effective number of neutrino species, N_{eff} , can be relaxed and the value of the Hubble rate inferred from the early Universe raised. Such models have been considered in the literature to alleviate tensions in cosmological data. We search for such sectors in the latest cosmological data sets, including BOSS galaxy clustering data. We present a detailed analysis, accounting for choice of prior boundaries and including the possibility of dark sector interactions with (a fraction of) the dark matter. We discuss the impact of these models on alleviating observational tensions in the value of the Hubble rate and the matter-clustering parameter S_8 .

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