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$\Delta N_{\text{eff}} \neq \Delta N_{\text{eff}}$ – Dark Radiation vs. Decaying Dark Matter vs. Equivalent Neutrinos

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The number of extra relativistic degrees of freedom, ΔN_{eff} , has recently received attention as a possible way to alleviate the Hubble tension. Non-standard values, i.e. $\Delta N_{\text{eff}} \neq 0$, can arise from different physical origins, such as the presence of additional ultra-relativistic species or non-standard values of the temperature ratio between photons and standard model neutrinos. In this talk I will show how these distinct origins of ΔN_{eff} yield different observable features by altering predictions for the CMB and matter power spectra as well as primordial element abundances from BBN in different ways. To obtain meaningful results a consistent treatment and implementation of BSM likelihoods and models is essential. I will discuss how these issues can be addressed with the new CosmoBit module of the Global and Modular Beyond-the-StandardModel Inference Tool (GAMBIT).

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