Type: Oral

Towards the SM Neff

Tuesday 3 December 2019 17:30 (15 minutes)

We revisit the SM calculation of Neff, motivated by results discrepant with the canonical value of $N_{\rm eff} = 3.044$ (Gariazzo, S. et al., 2019). We show that the discrepancy (which gave $N_{\rm eff} = 3.052$ (Grohs, E. et al. 2015)) stems from a misunderstanding of the interactions that take place in the plasma at finite temperature.

After clarifying common pitfalls, we follow this up by including previously ignored charge screening effects that lead to a decrease of $\delta N_{\rm eff} = -0.001$. This gives a change to $N_{\rm eff}$ that is around the same size as including neutrino oscillations and non-instantaneous decoupling has been shown to give (Gariazzo, S. et al., 2019). We argue that our findings should be included, therefore, in a full calculation of $N_{\rm eff}$.

We finish by re-estimating the electron neutrino decoupling temperature using the optical theorem at finite temperature in a self-consistent way, finding our results ($T_d = 1.42$ MeV) to be in agreement with the existing literature. We use this to argue that the formalism may be used to include higher order weak effects, which may lead to a further change in N_{eff} .

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