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The H0 tension alleviated through ultra-light primordial black holes: an information insight through gravitational waves

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"As it was recently argued, the Hawking evaporation of ultra-light primordial black holes (PBH) domi- nating the early universe can increase the effective number of extra neutrino species ΔNeff, which is proportional to the initial PBH abundance and the total number of extra degrees of freedom produced from Hawking evaporation on the top of the Standard Model (SM) ones. Hence, by increasing ΔNeff, one can alleviate the Hubble tension problem. These light PBHs can form a gas of Poisson
distributed compact objects which can induce at second order in cosmological perturbation theory a gravitational-wave (GW) background. Consequently, in this work, by avoiding overproduction of the above mentioned scalar induced GW background we derive model-independent constraints on the initial PBH abundance, ΩPBH,f as a function of their mass, mPBH and translate these constraints to constraints on ΔNeff finding at the end extremely small masses for PBHs, namely below the
Planck mass, which is excluded. By accounting as well for the fact that for extra degrees of freedom produced from Hawking evaporation at energies T ≫ 100MeV, ΔNeff ≪ 1 we find an extremely small upper bound on ΩPBH,f below the lowest value required for early PBH domination. At the end, we conclude that the scenario of early ultra-light PBH domination is excluded pointing out that in order to alleviate the Hubble tension through the portal of Hawking evaporation of ultra-light PBHs, one
should introduce a high number of light relativistic degrees of freedom with feeble couplings to the SM in order to recompensate for the low initial PBH abundances."

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