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# Precision Constraints on Nuclear and Neutrino Reactions via Big Bang Nucleosynthesis

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Astronomical observations of high precision ($N_{\rm eff}, Y_P, \omega_b, D/H_P, \Sigma m_\nu$) may soon over determine the cosmological standard model. An effort to constrain physics beyond the standard model with these observations is faced with the challenge of the interrelated problems of neutrino transport (via the quantum kinetic equations) and a stiff nuclear reaction network. We overview work on this topic, highlighting recent advances in our understanding of neutrino flavor evolution in the presence of their collisions with each other and matter in the early universe. We demonstrate, by concurrent solution of the neutrino and matter plasma evolution, percent-level effects on predicted deuterium abundances due to non-equilibrium distortions of the neutrino spectra, an order of magnitude larger than previous estimates. Preliminary results for coherent neutrino flavor evolution in the presence of collisions are also discussed.

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