

APR13-2012-000066

Abstract for an Invited Paper
for the APR13 Meeting of
the American Physical Society

Neutrinos And Big Bang Nucleosynthesis

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According to the standard models of particle physics and cosmology, the present Universe is filled with a background of cosmic neutrinos, similar to the cosmic microwave photon background. Due to the weakness of the weak interactions, this neutrino background is undetectable with current technology. The cosmic neutrino background can be probed indirectly through its cosmological effects on big bang nucleosynthesis (BBN) and the cosmic microwave background (CMB) radiation. In this talk, focused on neutrinos and “dark radiation,” the BBN constraints on the number of “equivalent neutrinos” (dark radiation), on the universal baryon asymmetry, and on a possible lepton asymmetry (neutrino degeneracy) are reviewed and updated. The BBN constraints on dark radiation and on the baryon density are in excellent agreement with the complementary results from the CMB, providing a suggestive, but currently inconclusive, hint of the presence of dark radiation and, they constrain any lepton asymmetry. For all the cases discussed here there is a “lithium problem”: the BBN-predicted lithium abundance exceeds the observationally inferred primordial value by a factor of ~ 3 .