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Neutrino Cosmology Redux

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Abstract:

The gauge-extended U(1)*C \times SU(2)_L \times U(1)*{I_R} \times U(1)*L model has the attractive property of elevating the two major global symmetries of the standard model (baryon number B and lepton number L) to local gauge symmetries. The U(1)_L symmetry prevents the generation of Majorana masses, leading to three superweakly interacting right-handed neutrinos. This also renders a B-L symmetry non-anomalous. We show that the superweak interactions of these Dirac states (through their coupling to the TeV-scale B-L gauge boson) permit right-handed neutrino decoupling just above the QCD phase transition: 175 MeV < T*{\nu_R}^{dec} < 250 MeV. In this transitional region, the residual temperature ratio between \nu_L and \nu_R generates extra relativistic degrees of freedom at BBN and at the CMB epochs. Consistency (within 1\sigma) with both WMAP 7-year data and the most recent estimate of the primordial ^4He mass fraction is achieved for 3 TeV < M_{B-L} < 6 TeV. The model is fully predictive, and can be confronted with dijet and dilepton data (or lack thereof) from LHC7 and, eventually, LHC14.

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