Lepton sourced baryon asymmetry in the fourth generation model

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We demonstrate that the observed baryon asymmetry in the Universe can be accommodated in the extended Standard Model with sequential fourth generation fermions (SM4). We first construct the dimension-6 effective operators $(\Phi^\dagger \Phi)\bar{U}_L \Phi D_R$ induced by fourth-generation heavy quarks, which carry the CP violation (CPV) source from the 4×4 Cabibbo-Kobayashi-Maskawa (CKM) matrix, Φ (U, D) being a Higgs double (up-type fermion, down-type fermion). The required inputs of the fourth generation fermion masses were derived in our earlier dispersive analyses on heavy quark decays and neutral quark state mixing through box diagrams. The similar analysis allows the determination of the 4×4 CKM matrix elements $V_{ib'}$, $i = u$, c and t, such that the strength of the CPV source for $f = \tau'$ and ν', i.e., fourth generation charged leptons and neutrino, respectively, can be fixed unambiguously. The dimension-6 operators for fourth generation leptons, as implemented into the formalism for the electroweak baryogenesis in the literature, lead to the baryon-over-entropy ratio $\eta_B \approx 10^{-10}$. As last, we discuss the potential for searching for fourth generation fermions at the LHC.

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