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Baryon Asymmetry and Corrections to Scaling Neutrino Mass Matrix in Type-I+II Seesaw Model under A_4 Modular Invariance

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The finite modular groups are isomorphic to permutation groups e.g. $\Gamma_3 \simeq A_4$. Apart from usual irreducible representations of the permutation groups, they have modular weights as new symmetry charges. The Yukawa couplings transforms as modular forms of complex modulus τ acquiring suitable charges of the underlying symmetry. In this work, we propose a scenario implementing the correction to scaling neutrino mass matrix and investigate baryogenesis based on A_4 modular symmetry within Type-I+II seesaw framework. In fact the scaling neutrino mass matrix results in vanishing reactor mixing angle (θ_{13}), inverted ordering of neutrino masses with vanishing lowest neutrino mass eigenvalue ($m_3 = 0$). In the proposed model, field content comprises of the standard model particles, two chiral neutrino superfields (N_1^c, N_2^c) and scalar singlet weighton field (ϕ) which results in scaling neutrino mass matrix through Type-I seesaw. The correction to scaling neutrino mass matrix is manifested through Type-II seesaw obtained by introducing a supersymmetric pair of scalar triplet fields (Δ,$\bar{\Delta}$). In particular, correction to scaling neutrino mass matrix is found to be proportional to modular Yukawa couplings of weight 10 ($Y^{10}_{1,1'}$). The model satisfies the neutrino oscillation data and cosmological constraint on sum of neutrino masses ($\sum m_i \leq 0.12$eV). The modular Yukawa couplings of modular weight 2 are sensitive to the imaginary part of complex modulus τ, only. Also, we have studied the implications of the model for neutrinoless double beta decay ($0\nu\beta\beta$). The effective Majorana mass parameter (M_{ee}) is found to be in range $(0.04 - 0.06)$ eV which is well within the sensitivity reach of $0\nu\beta\beta$ decay experiments. Furthermore, there exist robust lower bound on sum of neutrino masses ($\sum m_i \geq 0.05$ eV). Also, in order to generate a consistent baryon asymmetry of the universe the right-handed neutrino mass is found to be in the range $((1 - 5) \times 10^{13})$ GeV implying that the flavor effects are negligible.

Session

Neutrino Physics

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