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Neutrino Phenomenology in A_4 Modular Symmetry with Scoto Seesaw Mechanism

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The innovative aspect of this study is the introduction of a hybrid scoto-seesaw model based on A_4 discrete modular symmetry, which has many intriguing phenomenological implications. Using the type-I seesaw mechanism at the tree level, the scoto-seesaw framework generates one mass square difference ($\Delta m^2_{\rm atm}$). Furthermore, a clear explanation of the two distinct mass square differences is provided by the scotogenic contribution, which is essential in deriving the other mass square difference ($\Delta m^2_{\rm sol}$) at the loop level. Under the A_4 modular symmetry, Yukawa couplings undergo a non-trivial transformation that facilitates the investigation of neutrino phenomenology with a specific flavor structure of the mass matrix. Along with predicting neutrino mass ordering, mixing angles, and CP phases, this framework also provides precise predictions for $\sum m_i$ and $|m_{ee}|$. Specifically, the model predicts $\sum m_i \in (0.073, 0.097)$ eV and $|m_{ee}| \in (3.15, 6.66) \times 10^{-3}$ eV, which are within the reach of forthcoming experiments. Moreover, our model appears promising in addressing lepton flavor violations, including $\ell_\alpha \to \ell_\beta \gamma$, $\ell_\alpha \to 3\ell_\beta$, and $\mu - e$ conversion rates, while remaining consistent with current experimental limits.

Track type

Neutrino Physics

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