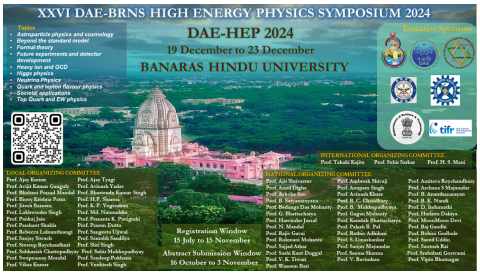


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# Neutrino Phenomenology in Scoto-Seesaw mechanism with Modular $A_4$ Symmetry

In this work, we study a hybrid scoto-seesaw mechanism based on modular $A_4$ symmetry, which has many interesting phenomenological implications. In this scoto-seesaw framework, the type-I seesaw mechanism generates the atmospheric mass square difference ($\Delta m^2_{\rm atm}$) at the tree level. Additionally, the scotogenic contribution plays a crucial role in obtaining the other mass square difference ($\Delta m^2_{\rm sol}$) at loop level, providing a clear understanding of the two distinct mass square differences observed in neutrino oscillations. The non-trivial transformations of Yukawa couplings under the $A_4$ modular symmetry facilitate the exploration of neutrino phenomenology, offering a specific flavor structure for the mass matrix. This model not only makes predictions regarding neutrino mass ordering, mixing angles, and CP phases, but it also yields precise predictions for $\Sigma m_i$ as well as $|m_{ee}|$. Specifically, the model predicts $\Sigma m_i$ within the range of (0.073, 0.097) eV and $|m_{ee}|$ in (3.15, 6.66)$\times 10^{-3}$ eV. Furthermore, our model shows promise in addressing lepton flavor violations, such as $l_\alpha \to l_\beta \gamma$, $l_\alpha \to 3 l_\beta$, all while remaining consistent with current experimental limits.

## Field of contribution

Theory

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**Track Classification:** Beyond the standard model