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Explicit Perturbations to the Stabilizer \tau = {\rm i} of Modular A^\prime_5 Symmetry and Leptonic CP Violation

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The finite modular symmetry provides us with an attractive and novel way to understand lepton flavor mixing, and has recently attracted a lot of attention. In a class of neutrino mass models with modular flavor symmetries, it has been observed that CP symmetry is preserved at the stabilizer of the modulus parameter $\tau = \mathrm{i}$, whereas significant CP violation emerges within the neighbourhood of this stabilizer. In this work, we first construct a viable model with the modular A_5' symmetry, and explore the phenomenological implications for lepton masses and flavor mixing. Then, we introduce explicit perturbations to the stabilizer at $\tau = \mathrm{i}$, and present both numerical and analytical results to understand why a small deviation from the stabilizer leads to large CP violation. As low-energy observables are very sensitive to the perturbations to model parameters, we further demonstrate that the renormalization-group running effects play an important role in confronting theoretical predictions at the high-energy scale with experimental measurements at the low-energy scale.

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