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Quark and lepton hierarchies from S4' modular flavor symmetry

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We propose models in which the hierarchical structures of the masses and mixing in both quark and lepton sectors are explained by the S4' modular flavor symmetry near the fixed point Im \tau » 1. The model provides the first explicit example which explains hierarchies of both quarks and leptons by a single modular flavor symmetry. The hierarchies are realized by powers of \epsilon := e^{2\pi i\tau/4} = O(0.01) and Im\tau ~ 5, where \tau being the modulus. The small parameter \epsilon plays a role of flavon in the Froggatt-Nielsen mechanism under the residual Z^T_4 symmetry, and powers of 2Im\tau in the Yukawa couplings are controlled by modular weights via the canonical normalization. The doublet quarks are identified to a S4^\prime triplet to explain the hierarchical structure of the quark mixing angles, while the doublet leptons are composed of three singlets for the large mixing angles in the lepton sector. We show that the S4' modular symmetry alone can explain the hierarchies in both quark and lepton sectors by O(1) coefficients. This work is based on arXiv:2301.07439 and 2302.11183 [hep-ph].

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