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Implications of the Zero 1-3 Flavour Mixing Hypothesis: Predictions for \theta_{23}^PMNS and \delta_PMNS$

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We revisit mixing sum rule relations in the lepton and quark sectors under the assumption that the 1-3 elements of the flavour mixing matrices ($V_L^u, V_L^d, V_L^e, V_L^\nu$) are zero in the flavour basis. We consider the exact relations resulting from the validity of this zero 1-3 flavour mixing hypothesis and analyse their implications based on the current experimental data, including effects from RG running. In particular, we analyse how the existing precise measurement of $\theta_{13}^{\rm PMNS}$ allows to derive predictions for $\theta_{23}^{\rm PMNS}$ in models with constrained $\theta_{12}^{\rm e}$. As examples, we discuss the predictions for $\theta_{23}^{\rm PMNS}$ which arise in classes of Pati-Salam models and SU(5) GUTs that relate $\theta_{12}^{\rm e}$ to $\theta_{12}^{\rm d}$. We also derive a novel lepton phase sum rule, valid under the additional assumption of small charged lepton mixing contributions. We furthermore point out that, in the context of GUT flavour models, the quark and lepton CP violating phases $\delta^{\rm CKM}$ and $\delta^{\rm PMNS}$ can both be predicted from a single imaginary element in the mass matrices.

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