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A Study of Mass Matrices with Permutational Symmetry for Quark Families

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A set of 3×3 mass matrices are identified that have eigenstates that are mathematically equivalent to conventional QCD color states, and which have mass eigenvalues equal to the three quark flavor masses, for each of the two quark families. When integrated into the Dirac equations for each family, one obtains a theory that satisfies, TCP, Lorentz, $U(1)$, and $SU(2)_L$ transformations, as well as parity and charge conjugation. With this approach, one obtains 3 degenerate mass eigenstates per color and flavor, which permits a unique and accurate fit of the CKM matrix, and a physical rationale is provided. $SU(3)$ is not automatically satisfied for the mass terms in this theory. This is addressed by using an $SU(3)$ Higgs mechanism, which is complementary with $SU(2)_L$ in creating mass in this theory for quarks.

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