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Anarchy In Unified Theories

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In Standard Model, massive fermions show strong hierarchy in their Yukawa couplings among the different generations and the CKM angles are related to the small mass ratios between fermions of different generations, that is why the quark mixing angles are quite small and the CKM matrix is almost close to unit matrix. In contrast Neutrino mixing angles are quite large. To incorporate all the masses and mixing, the mass matrices show strong hierarchy among the different generations. It is shown that the hierarchy among generations can arise as a consequence of mixing of ordinary fermions with three generations and other fermions, which have masses of order the GUT scale. Except the few parameters present in the model due to the mixing between light and super-heavy fermions, all the quark and lepton mass matrices are of order unity. It is exciting that even without the hierarchical structure of the mass matrices, large lepton mixing can also be reproduced.

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