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Fermion mass and mixing hierarchies from E8-inspired left-right-color-family Grand-unification

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We present a Grand Unified Theory where the usual E6 gauge coupling unification is supplemented by a local SU(2)×U(1) family symmetry. We discuss its origin inspiring our model by an embedding into E8 which can be seen as an unifying force. We argue that the presence of such a family symmetry has remarkable implications for both high-scale and low scale physics: First, while the usual 273 cubic interactions in the superpotential are forbidden, tree-level Yukawa terms are generated via dimension-four operators upon the breaking of E6 down to its trinification maximal subgroup. Such a breaking will also induce sizable threshold corrections to the gauge couplings at the E6 scale which modifies their running in such a way that it becomes possible to attain a low scale unification picture not far from the reach of a Future 100 TeV Circular Collider. On the other hand we demonstrate that the masses of leptons and first generation quarks are of radiative origin whereas second and third quark families are tree-level generated. This results in a CKM-mixing with the Cabibbo where deviations from unitarity are induced via mixing with down-type vector-like quarks as well as radiative corrections.

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