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Fermion mass hierarchy and new physics at the TeV scale

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We present a new framework to understand the long-standing fermion mass hierarchy puzzle. We extend the Standard Model gauge symmetry by an extra local $U(1)_S$ symmetry, broken spontaneously at the electroweak scale. All the SM particles are singlet with respect to this $U(1)_S$. We also introduce additional flavor symmetries, $U(1)_{F_i}$'s, with flavon scalars F_i , as well as vectorlike quarks and leptons at the TeV scale. The flavon scalars have VEV in the TeV scale. Only the top quark has the usual dimension four Yukawa coupling. EW symmetry breaking to all other quarks and leptons are propagated through the messenger field, S through their interactions

involving the heavy vector-like fermions and S , as well as through their interactions involving the vector-like fermions and F_i . In addition to explaining the hierarchy of the charged fermion masses and mixings, the model has several interesting predictions for Higgs decays, flavor changing neutral current processes in the top and the b quark decays, decays of the new singlet scalars to the new Z'

boson, as well as productions of the new vectorlike quarks. These predictions can be tested at the LHC. I will also briefly review the other approaches to the fermion mass hierarchy puzzle.

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