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A road to a beyond the Standard Model model

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We describe examples of renormalizable field theories where the breaking of chiral symmetry at the UV cutoff leaves behind at low energy dynamically generated elementary particle masses in a way alternative to the Higgs mechanism. In this scenario 1) the scale of the elementary particle masses is set by the RGI scale of the theory 2) masses are kept "small" owing to an enhanced chiral symmetry enjoyed by the massless theory, thus solving the 't Hooft naturalness problem, 3) in order to match the experimental value of the top mass, a super-strongly interacting sector, gauge-invariantly coupled to standard matter, needs to exist with an RGI scale, Λ≫ΛSM, of the order of a few TeV's, 4) the peculiar dependence of the non-perturbatively generated masses upon the gauge couplings is such that it may offer a hint to solve the mass hierarchy problem, 5) Λ sets the order of magnitude of the electro-weak scale, 6) the 125 GeV resonance recently identified at LHC is interpreted as a +− composite state bound by exchanges of super-strongly interacting particles to which the electro-weak bosons are coupled,
7) at (momenta)2≪Λ2 the couplings of the composite Higgs boson with quark, leptons and electro-weak bosons deviate from those of the Standard Model by O() corrections, 8) with a reasonable choice of particle content, a theory extending the Standard Model with the inclusion of the new super-strong sector exhibits gauge coupling unification at a scale ~1018GeV making the proton life time comfortably larger then the present limit of 1.7×1034 years.

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