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Check of a new non-perturbative mechanism for elementary fermion mass generation

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We consider a field theoretical model where a $SU(2)$ doublet fermion, subjected to non-abelian gauge interactions, is also coupled to a complex scalar field doublet via a Yukawa and an irrelevant Wilson-like term. Despite the presence of these two chiral breaking operators in the Lagrangian, an exact symmetry acting on fermions and scalars prevents perturbative mass corrections. In the phase where fermions are massless (Wigner phase) the Yukawa coupling can be tuned to a critical value at which chiral transformations acting on fermions only become a symmetry of the theory (up to cutoff effects). In the Nambu-Goldstone phase of the critical theory a fermion mass term of dynamical origin is expected to arise in the Ward identities of the purely fermionic chiral transformations. Such a non-perturbative mechanism of dynamical mass generation can provide a “natural” (à la ‘t Hooft) alternative to the Higgs mechanism adopted in the Standard Model.

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