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Chiral symmetry-breaking schemes and dynamical generation of masses and field mixing

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A careful study of flavor mixing in Quantum Field Theory reveals an hidden structure, which is due to the presence of Bogoliubov transformations in addition to the mixing rotation [1].
This is deeply related to the presence of unitarily inequivalent representations of the field algebra [2]. Far from being only a mathematical curiosity, this study leads to phenomenological corrections to the neutrino oscillations formula [3]. The extension of the previous analysis to the three flavor case was performed in Ref.[4] where the structure of flavor charges and currents was analyzed and CP and T violations were explicitly evaluated.

The particle-antiparticle condensate structure of the flavor vacuum suggests the idea of fermion mixing as an emergent dynamical phenomenon [5]. A non-perturbative study of two-flavor chiral symmetric models was performed by means of algebraic methods and the emergence of Nambu-Goldstone modes was analyzed by means of the Ward-Takahashi identities [6]. This study shows that dynamical generation of flavor mixing requires the existence of exotic condensates in the vacuum, mixing different flavors with each other. We are currently investigating the extension to the three-flavor case with CP-violating phase and the associated patterns of symmetry breaking [7].

References

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Content of the contribution

Theory

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