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A QCD Lagrangian including renormalizable NLJ terms

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A local and gauge invariant version of QCD Lagrangian is introduced. The model includes Nambu- Jona-Lasinio (NJL) terms within its action in a surprisingly renormalizable form. This occurs thanks to the presence of action terms which at first sight, look as breaking power counting renormalizability. However, those terms also modify the quark propagators, to become more decreasing than the Dirac propagator at large momenta, indicating power counting renormalizability. The approach, can also be interpreted as generalized renormalization procedure for massless QCD. The free propagator, given by the subtraction between a massive and a massless Dirac ones, in the Lee-Wick form, suggests that the theory also retains unitarity. The appearance of finite quark masses already in the tree approximation in the scheme is determined by the fact that the new action terms explicitly break chiral invariance. The approach looks as being able to implement the Fritzsch Democratic Symmetry breaking ideas about the quark mass hierarchy. Also, it seems that a link of the theory with the SM can follow after employing the Zimmermann's couplings reduction scheme. The renormalized Feynman diagram expansion of the model is written here and the formula for the degree of divergence of the diagrams is derived. The primitive divergent graphs are identified and the two gluon legs ones are evaluated. The result shows the required gauge invariant transversal structure.

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