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How to properly formulate QCD sum rules for exotic tetraquarks

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We show the proper way to extract characteristics of tetraquark states within the method of QCD sum rules. We emphasize that duality relations for correlators involving tetraquark currents have fundamental differences compared with the duality relations for the correlators of bilinear quark currents: namely, the $O(1)$ and $O(\alpha_s)$ terms in the OPE for the exotic correlators exactly cancel against the contributions of the two-meson states on the phenomenological side of QCD sum rules. Consequently, the tetraquark properties turn out to be related to the specific non-factorizable parts of the OPE for the exotic Green functions; the relevant non-factorizable diagrams start at order $O(\alpha_s^2)$. Moreover, we demonstrate that all appropriate diagrams may be easily obtained from those Feynman diagrams for the four-point function of bilinear quark currents which contain four-quark s-channel singularities. Our findings call for a massive revision of the existing results for tetraqarks and pentaquarks obtained from QCD sum rules.

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