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Interplay between symmetry and dynamics in the pole structure of the three-gluon vertex

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It is well established that the Schwinger mechanism generates a nonperturbative mass for gluons through the emergence of massless poles in the fundamental QCD vertices. In this work, we examine the pole structure of the three-gluon vertex, analyzing its patterns and residues using two complementary approaches: the Slavnov-Taylor identity, which encapsulates the vertex's symmetry properties, and the nonlinear Schwinger-Dyson equation, which dictates its dynamical evolution. Our findings show that both methods produce consistent results, confirming a nonzero residue for the vertex. The model-independent nature of these results underscores the deep interplay between symmetry and dynamics in the theory, offering a nontrivial self-consistency test for this mass-generation mechanism.

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