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Complex poles of Landau-gauge QCD propagators and general properties

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We study analytic structures of the gluon, quark, and ghost propagators in the Landau-gauge QCD and general properties from the existence of unusual singularities. First, we investigate analytic structures of the QCD propagators using the massive Yang-Mills model, in which the one-loop gluon and ghost propagators are in good agreement with the numerical lattice results in the Landau gauge. We find that both gluon and quark propagators in this model have complex poles that invalidate the usual spectral representation. Second, we discuss general properties of propagators in the presence of such complex singularities, especially on the positivity and locality. Finally, we consider a possible quantum mechanical interpretation and implications on a confinement mechanism.

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