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Complex poles of QCD propagators and their interpretation

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We consider the analytic structures of the gluon, quark, and ghost propagators in the Landau-gauge QCD and their implications. We first investigate the analytic structure of the QCD propagators using the massive Yang-Mills model, an effective model of the Landau-gauge Yang-Mills theory. It turns out that the gluon and quark propagators in this model have complex poles that invalidate the usual spectral representation. We then discuss formal aspects of complex singularities of propagators, especially on the reflection positivity and locality, and consider their implications on a possible quantum mechanical interpretation and confinement mechanism.

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