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Probing the singularities of the Landau gauge gluon and ghost propagators with rational approximants

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Padé approximants are employed in order to study the analytic structure of the four-dimensional SU(2) Landau-gauge gluon and ghost propagators in the infrared regime. The approximants, which are model independent, are used as fitting functions to lattice data for the propagators, carefully propagating uncertainties due to the fit procedure taking into account all possible correlations. Applying this procedure systematically to the gluon propagator data, we observe the presence of a pair of complex poles at $p^2_{\rm pole} = (-0.37 \pm 0.05_{\rm stat} \pm 0.08_{\rm sys}) \pm (0.66 \pm 0.03_{\rm stat} \pm 0.02_{\rm sys})i$ GeV^2, where the first error is statistical and the second systematic, and also a zero at the negative real axis of p^2, at $p^2_{\rm zero} = (-2.9 \pm 0.4_{\rm stat} \pm 0.9_{\rm sys})$ GeV^2. For the ghost propagator, the Padés indicate the existence of the single pole at $p^2 = 0$, as expected. The presence of the pair of complex poles in the gluon propagator, already hinted upon in previous works, is now put into a more firm basis thanks to the model independence and careful error propagation of our procedure.

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