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Signatures of the Yang-Mills deconfinement transition from the gluon two-point correlator

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We evaluate the longitudinal or (chromo-)electric Yang-Mills gluon propagator in the recently proposed center-symmetric Landau gauge at finite temperature [1]. To model the effect of the Gribov copies in the infrared, we use the Curci-Ferrari model which, in turn, allows us to rely on perturbative calculations. At one-loop order in the $SU(2)$ case, the so-obtained longitudinal gluon propagator provides a clear signature for Z_2 center-symmetry breaking with a singular behavior, characteristic of a continuous phase transition. This is in sharp contrast with what is found within the standard Landau gauge. We also identify various signatures for Z_3 center-symmetry breaking in the $SU(3)$ case in the form of genuine order parameters. Among those, we find that the gluon propagator, although degenerate along the diagonal color directions in the confining phase, becomes non-degenerate in the deconfined phase. Our results open new ways of identifying the transition from correlation functions both within continuum approaches and on the lattice.

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