Abstract

We report on results for the Landau gauge gluon propagator computed from large statistical ensembles and look at the compatibility of the results with the Gribov-Zwanziger tree level prediction for its refined and very refined versions. Our results show that the data is well described by the tree level estimate only and very refined versions. Our results show that the Gribov-Zwanziger tree level prediction for its refined propagator computed from large statistical ensembles becomes negligible at high momentum and very refined versions. Our results show that the Gribov-Zwanziger tree level prediction for its refined propagator computed from large statistical ensembles becomes negligible at high momentum and very refined versions.

Lattice Landau gauge gluon propagator

\[
\Delta_\Sigma(p) = 1 + \sum_{n=1}^{\infty} n^2 \delta(n^2) \frac{p^2}{n^2 + m^2}
\]

- lattice momentum
- continuum momentum
- orthogonal projector

Lattice simulations

- two large physical volume lattice simulations
- Wilson gauge action, \( \beta = 6.0 \)
- 1/4 = 1.943 GeV, \( a = 0.1016(25) \) fm,
- 64- and 80- lattice volumes:
- physical volumes: (6.57 fm)², (8.21 fm)²
- number of configurations: 2000, 550
- rotated to the Landau gauge
- \( \rho_{max} = 191 \) MeV, 153 MeV: \( \rho_{max} = 7.7 \) GeV
- renormalization: MOM scheme, scale \( \mu = 3 \) GeV
- conical and cylindrical cuts for \( p > 0.7 \) GeV
- all lattice data for \( p < 0.7 \) GeV

Global Fits: from Infrared to Ultraviolet

- for large \( p^2 \) one expects to recover the usual perturbative behaviour
- \( D(p^2) \sim \frac{1}{p^2 M^2} \left[ \frac{n(p^2)}{\Lambda_{QCD}} \right]^2 \)
- \( \nu = \frac{1}{2} \) → 1-loop gluon anomalous dimension
- Interpolation between
  - RGZ for low \( p \)
  - 1-loop RG-improved expression for high \( p \)
  - \( \omega = \frac{1}{2} \Lambda_{QCD} \) \( \omega \) = 0.425 GeV, \( a_s(3 \) GeV \) = 0.3387

For more information...

... see arXiv:1803.02281 [hep-lat]

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