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Lattice QCD Study for Gluon Propagator and Gluon Spectral Function

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The gluon propagator is studied in the Landau gauge in SU(3) lattice QCD at $\beta=5.7, 5.8$ and 6.0 at the quenched level.

Through the functional-form analysis of the gluon propagator obtained in lattice QCD, we find that the Landau-gauge gluon propagator is well described by the Yukawa-type function e^{-mr}/r with $m=600\text{MeV}$ for $r=0.1-1.0\text{fm}$ in the four-dimensional Euclidean space-time [1].

Associated with the Yukawa-type gluon propagator, we derive analytical expressions for the effective mass and the spectral function $\rho(\omega)$ of the gluon field [1]. As a remarkable fact, the obtained gluon spectral function $\rho(\omega)$ is almost negative definite, except for a positive delta-functional peak at $\omega=m$.

We also investigate the relevant gluonic energy scale for the effective gluon mass using the new lattice technique in Ref.[2].

References

- [1] T. Iritani, H. Suganuma and H. Iida, Phys. Rev. D80, 114505 (2009).
- [2] A. Yamamoto and H. Suganuma, Phys. Rev. Lett. 101, 241601 (2008); Phys. Rev. D79, 054504 (2009); Phys. Rev. D81, 014506 (2010).

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