The study for $SU(3)$ gluon propagator and screening mass at finite temperature

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Quark-gluon plasma(QGP), a new phase of QCD, has been searched for extensively by heavy ion collisions. Theoretical study of QGP at high temperature is urgent. On such high temperature phase, nonperturbative technique becomes very essential tool.

By lattice QCD simulations, studies of the nature of the phase transition, its critical temperature and the equation of state above critical temperature, have been performed by a long period and we have accumulated important information on QGP phase.

In QGP phase the gluon propagator is expected to be dressed by their interactions and to be characterized as massive particles. And then the behavior of screening masses affects the quark potential.

Our aim here is to perform a direct research of $SU(3)$ gluon propagators by nonperturbative method and investigate temperature dependences of electric and magnetic screening parts at finite temperature. Studies along this line have been performed in the case of $SU(2)$ lattice simulation[1] and 3-dQCD[2], but the $SU(3)$ case has not done yet. Here, to carry out those we use quenched $SU(3)$ lattice gauge theory by using the stochastic gauge fixing method[3,4].

Althought a gluon propagator is gauge dependent quantity and not physical object, through the gauge fixed propagator, we can extract the mass which is considered as the physical object and expected to be gauge invariant. In perturbative level, we can easily check the gauge dependence. However, in nonperturabative regions it is not trivial whether the screening masses are gauge invariant or not. We also check their gauge dependence.

References

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