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Ghosts in Nonequilibrium Quark-Gluon Plasma

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The quark-gluon plasma at the early stage of relativistic heavy-ion collisions is out of equilibrium. The Keldysh-Schwinger formalism provides a natural framework to describe such a plasma, in particular when the plasma is weakly coupled and perturbative methods are applicable. However, a perturbative computation of various QCD characteristics requires Faddeev-Popov ghosts to cancel unphysical degrees which are present in a wide class of covariant gauges. The question thus arises how to introduce the ghosts for non-equilibrium QCD. Using the functional methods, we derive a relation analogous to the Slavnov-Taylor identity which expresses the ghost propagator of the Keldysh-Schwinger formalism through the gluon one. Then we show that the ghost propagator obtained in this way allows one to construct a gauge invariant perturbative expansion of various characteristics of non-equilibrium quark-gluon plasma.

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