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The gluon condensates and the QGP equation of state

Content :

From the heavy ion collisions performed at RHIC we have strong evidence
of the formation of a hot, dense, deconfined and strongly interacting
system: the sQGP. This is in sharp contrast with a weakly interacting gas
of quarks and gluons, described by perturbative QCD. In fact, above the
deconfining phase transition the system still has non-perturbative
interactions. For astrophysical applications and also to understand heavy ion
collisions we need to know the equation of state (EOS) of the sQGP. This EOS
must be employed in hydrodynamical simulations of the sQGP evolution. In this
work we derive a simple EOS for the sQGP at zero temperature with non-perturbative
interactions driven by the dimension 2 and 4 gluon condensates. We start with the QCD
lagrangian and perform a separation of the gluon field in soft (low momentum) and
hard (high momentum) modes. The soft fields will give origin to the condensates and
for the hard fields we make a mean-field approximation, similar to the one used in
the Walecka model. We compare the obtained results with the MIT EOS.

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