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Develop a beyond HTL/HDL theory to handle the QCD phase transition

We build an High Density Effective Field Theory for quark matter at finite temperature and density. In analogy with the non-relativistic quantum chromodynamics theory (NRQCD), we divide the quark field into relevant and irrelevant modes, then integrating out the irrelevant mode to obtain the effective Lagrangian. The mass term of gluon field appear after this operation. We compare our result with the hard thermal loop (HTL) and hard dense loop theory (HDL), the effective gluon mass for the 0-th gluon field A_0^a agree with the screening mass in HTL/HDL in the massless quark condition and our results cover the HTL/HDL theory in the high temperature or high density condition. A superior character of our theory is that we do not have to deal with the infrared divergence and the ultraviolet divergence using renormalization in our computation, and our results go beyond the HTL/HDL theory for covering all range of temperature T and quark chemical potential μ_f compare to the momentum of the gluon field.

Topics

Heavy Flavour Physics

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