Research plan

Masahiro Inui

In the quark-gluon plazma (QGP), the pressure plays a central role. We can get several phyiscal quantities from the pressure. The perturbative expansion of the pressre in the QGP is known up to 6th order in g (the QCD coupling constant). This result has flowing problems.

- The accuracy of the approximation, within the $\overline{\text{MS}}$ scheme, does not improve by inclusion of higher order terms (convergence issue).
- The pressure, in the $\overline{\text{MS}}$ scheme, does not agree with the lattice results.

Before now, I apply the PMS to the perturbative expansion (in the $\overline{\text{MS}}$ scheme), with the hope that improving above problems. The PMS is the guiding principle of the decision of the renormalization scheme.

My results had an obvious improvement in respect to agree with the lattice results, compared with the one by the $\overline{\text{MS}}$ scheme. I'm trying to improve the convergence issue too by the PMS.

The QGP is treated by the QCD in the finite temperature and finite density (Thermal Field Theory). According to The Thermal Field Theory, the physical quantities in the high energy and high density, like in the early universe, had calculated. Recently, in analogous circumstance with the condensed matter physics, the studies about a diquark which is expected to exist in low temperature and high density system becomes active. Now several physical phases are expected in QGP, accordingly I attempt the analysis of those physical phase.

On the other hand, Astronomic observation caught the signals as like as not "quark star" after 2000. It is interesting that analysing about the structure of quark star (magnetism, pressure and so on). I try to construct a model of the quark star, and calculate several physical quantities. To proceed above plans, and to bring phase structure of QGP complete, are the part of The Thermal Field Theory.