Quark Matter 2014 - XXIV International Conference on Ultrarelativistic Nucleus-Nucleus Collisions



Contribution ID: 368

Type: Contributed Talk

The QCD Equation of State at $\mathcal{O}(\mu_{\mathbf{B}}^{4})$

Tuesday 20 May 2014 11:50 (20 minutes)

Hydrodynamic models of heavy-ion collisions have increasingly begun to rely on lattice results for the Equation of State[1]. While the lattice has the advantage of being a first-principles approach to QCD, the notorious sign problem prevents a direct determination of the equation of state and other thermodynamic observables at finite baryon chemical potential μ_B .

In our talk, we will present results from a high-statistics calculation of all the Taylor coefficients upto sixth order in a (μ_B, μ_Q, μ_S) -expansion of the pressure. Our calculation allows us to extrapolate, for the first time, the equation of state on the freezeout curve upto $\mathcal{O}(\mu_B^4)$ while our sixth-order results show that the truncation error is not more than a few % upto $\mu_B/T \sim 1.5$. Thus our equation of state should be useful in describing both the LHC results as well as results from RHIC beam energy scan down to ~20 GeV. We will also use our results to construct the isentropic equation of state for strangeness-neutral systems.

Our lattice QCD calculations make use of the gauge ensembles generated using the HISQ action[2,3]. Our lattice sizes range from 6×24^3 to 12×48^3 . The pion mass (~160 MeV) is nearly equal to its physical value while the strange quark mass has been set to exactly its physical value.

References

[1] See for e.g. C. Gale, S. Jeon and B. Schenke, Int. J. Mod. Phys. A28, 1340011 (2013); C. Shen, U. Heinz, P. Huovinen and H. Song, Phys. Rev. C82, 054904 (2010).

[2] A. Bazavov et al. [HotQCD Collaboration], Phys. Rev. D86, 035409 (2012).

[3] A. Bazavov, H.-T. Ding, P. Hegde, O. Kaczmarek, F. Karsch, E. Laermann, Y. Maezawa, S. Mukherjee, H. Ohno, P. Petreczky, C. Schmidt, S. Sharma, W. Soeldner and M. Wagner, Phys. Rev. Lett. **111**, 082301 (2013).

Author: Dr HEGDE, Prasad (Central China Normal University)

Presenter: Dr HEGDE, Prasad (Central China Normal University)

Session Classification: QCD at high temperature and/or density

Track Classification: QCD at High Temperature and/or Density