Contribution ID: **139** Type: **Talk**

Calculating QCD phase diagram trajectories of nuclear collisions using a semi-analytical model

Wednesday 15 June 2022 08:40 (20 minutes)

Including the finite nuclear thickness has been shown to significantly affect the calculated energy density $\epsilon(t)$ [1] from the primary collisions of heavy ions at moderate or low energies. As a result, the peak density reached during the collisions can be much lower than the predicted initial density from the Bjorken formula. Recently we have extended the model to also calculate the conserved-charge (B, Q, S) densities from the primary collisions, which then allowed us to extract the time dependence of the temperature T and chemical potentials μ of the matter produced in central Au+Au collisions [2].

In this talk, I will discuss our semi-analytical model of the initial production that includes the nuclear thickness effect. I will first show our results of $\epsilon(t)$, $n_B(t)$, $n_Q(t)$, and $n_S(t)$ in comparison with those predicted by the Bjorken model. Next, I will show the extracted $T(t)$, $\mu_B(t)$, $\mu_Q(t)$, and $\mu_S(t)$ for a QGP using quantum statistics and Boltzmann statistics. Then, I will present our results on the $T - \mu_B$ trajectories, highlighting how they depend on the chosen statistics and parton formation time τ_F in relation to the possible location of the critical end point (CEP). I will also show that the strangeness neutrality $n_S(t) = 0$ leads to the relation $\mu_B(t) - \mu_Q(t) - 3\mu_S(t) = 0$, and that the assumption of $\mu_Q(t) = 0$ with $\mu_S(t) = \mu_B(t)/3$ is appropriate to simplify the mapping between densities and $T-\mu$ values. Finally, I will show the effect of transverse expansion on the event trajectories and also compare with trajectories of isentropic expansion that are obtained with lattice QCD equation of state.

References

[1] T. Mendenhall and Z. W. Lin, Phys. Rev. C **103** 024907 (2021).
[2] T. Mendenhall and Z. W. Lin, arXiv:2111.13932 [nucl-th].

Present via

Offline

Primary author: MENDENHALL, Todd

Co-author: LIN, Zi-Wei (East Carolina University)

Presenter: MENDENHALL, Todd

Session Classification: PA-Bulk matter phenomena, QCD phase diagram, and Critical point

Track Classification: Bulk matter phenomena, QCD phase diagram, and Critical point