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The isentropic equation of state of (2+1)-flavor QCD: An update based on high precision Taylor expansion and Pade-resummed expansion at finite chemical potentials

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We update the pressure, energy density and entropy density calculations at non-zero checmial potentials based on Taylor expansion up to 6th order performed by the HotQCD Collaboration in 2017.
The HotQCD collaboration has now accumulated an order of magnitude larger statistics for lattices with temporal extent
Nt=8 and 12 and added results for Nt=16 that were not available previously.
For Nt=8 we also calculated the 8th order expansion coefficients.
Furthermore, we showed that the straightforward Taylor series expansion for the pressure provides a well controlled description of the pressure upto $\mu_B/T \leq 2.5$.

In this talk, we will use the high statistics results on Taylor expansion coefficients, calculated with HISQ fermions and extrapolated to the continuum limit, for a determination of the QCD equation of state under conditions relevant for the description of hot and dense matter created in heavy ion collisions. We determine energy density and pressure along lines of constant entropy per net baryon-number.

We furthermore use the eighth order Taylor series for the pressure to construct Pade-resummed thermodynamic observables along lines of fixed entropy per baryon number-density and comment on the location of singularities in the complex chemical potential plane that influence the convergence of the Taylor series for bulk thermodynamic observables.
At low temperature we compare our results with hadron resonance gas (HRG) model calculations based on the recently constructed QMHRG2020 hadron list, which in addition to the hadronic resonances listed by the Particle Data Group, also includes resonances calculated in relativistic quark models.

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