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Constraining the QCD equation of state with identified particle spectra

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The equation of state is one of the fundamental properties of the QCD matter created in relativistic nuclear collisions. Lattice QCD simulations now provide a realistic equation of state at vanishing density, but it may differ from what we should see in the experiments because heavy-ion systems may be out of chemical equilibrium, in strong magnetic fields and affected by finite size effects. It is thus important to understand the imprints of the equation of state on the data.

We find that the mean transverse mass as a function of the multiplicity density reproduces, up to proportionality factors, the energy over entropy ratio as a function of the entropy density [1]. We perform viscous hydrodynamic simulations using a variety of equations of state and compare the results to the experimental data. The equations of state with the effective number of degrees of freedom equal to or larger than that of lattice QCD are favored. We also discuss how we can constrain the equation of state at finite baryon density.

[1] A. Monnai and J.-Y. Ollitrault, Phys. Rev. C 96, 044902 (2017), arXiv:1707.08466 [nucl-th]

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