Contribution ID: **24** Type: **Poster presentation**

Adiabatic hydrodynamization in the bottom-up thermalization scenario

In this talk we demonstrate that the early stages of the bottom-up thermalization scenario [1] are well described by the adiabatic hydrodynamization framework. All of the qualitative features exhibited in QCD effective kinetic theory (EKT) simulations at weak coupling [2] are captured by the emergence of an effective low-energy instantaneous ground state for the 1-particle gluon distribution function, which defines the early-time kinetic theory attractor. This ground state may be pulled back to arbitrarily early times, where it represents a free-streaming solution, and at later times it integrally describes the BMSS fixed point, including the recently observed deviations from the original predictions for the scaling exponents [2].

Our discussion is guided by our observations of the deep connections between scaling and adiabaticity in expanding gluon plasmas [3]. To showcase this, we first solve the Boltzmann equation for gluons in the small-angle scattering approximation numerically and find that time-dependent scaling is a feature of this kinetic theory, capturing the QCD EKT scaling of hard gluons [2]. We then proceed to study scaling analytically and semi-analytically in this equation. We find that an appropriate momentum rescaling allows the scaling distribution to be identified as the instantaneous ground state of the operator describing the evolution of the distribution function, and the approach to the scaling function is described by the decay of the excited states. That is to say, there is a frame in which the system evolves adiabatically, and the instantaneous ground state describes the early-time kinetic theory attractor. We obtain this ground state analytically. Corrections to the BMSS fixed point exponents in the small-angle approximation agree quantitatively with those found previously in QCD EKT and arise from the evolution of the ratio between hard and soft scales.

[1] R. Baier, A.H. Mueller, D. Schiff and D.T. Son, "'Bottom up'thermalization in heavy ion collisions,"Phys. Lett. B 502 (2001) 51
[2] A. Mazeliauskas and J. Berges, "Prescaling and far-from-equilibrium hydrodynamics in the quark-gluon plasma,"Phys. Rev. Lett. 122 (2019) 122301
[3] J. Brewer, B. Scheihing-Hitschfeld and Y. Yin, "Scaling and adiabaticity in a rapidly expanding gluon plasma,"arXiv:2203.02427 [hep-ph]

Authors: SCHEIHING HITSCHFELD, Bruno Sebastian (Massachusetts Institute of Technology); BREWER, Jasmine Therese (CERN); YIN, Yi (Institute of modern physics, Chinese Academy of Sciencessti)

Presenter: SCHEIHING HITSCHFELD, Bruno Sebastian (Massachusetts Institute of Technology)

Session Classification: Poster session