Contribution ID: **292** Type: **Parallel Talk**

Estimating nucleon substructure properties in a unified hydrodynamic model of p+Pb and Pb+Pb collisions

Tuesday, 15 May 2018 16:20 (20 minutes)

Simulations of relativistic heavy-ion collisions based on viscous hydrodynamics provide an accurate description of the bulk observables measured at RHIC and LHC beam energies, including identified particle yields, mean p_T and multiparticle correlations. The success of the hydrodynamic framework, however, is naturally expected to break down in the dilute limit where discrete particle degrees of freedom dominate.

It was thus surprising when the multiparticle correlations measured in high-multiplicity proton-lead collisions were found to be similar in magnitude to those observed in lead-lead collisions. The observation suggests that hydrodynamic behavior could be manifest in small droplets of quark-gluon plasma (QGP), and that flow might develop at length scales smaller than a proton.

In this work, we posit the existence of hydrodynamic flow in small collision systems and evaluate the likelihood of our assertion using Bayesian inference. Specifically, we model the dynamics of proton-lead and lead-lead collisions at $\sqrt{s_{NN}} = 5.02$ TeV using QGP initial conditions with parametric nucleon substructure, a pre-equilibrium free-streaming stage, event-by-event viscous hydrodynamics, and a microscopic hadronic afterburner.

Bayesian parameter estimation is used to construct the posterior probability distribution for the model's input parameters, calibrated to fit the charged particle yields, meant p_T and flow cumulants of both collision systems. We then sample preferred regions of parameter space and evaluate the performance of the model using optimally chosen parameter values. This semi-exhaustive model validation enables us to to comment on the implied viability of hydrodynamics in small collision systems subject to the approximations of the chosen framework. We conclude by presenting posterior constraints on the shape of the proton and temperature dependence of QGP transport coefficients, and discuss relevant implications for hot and dense nuclear matter.

Content type

Theory

Collaboration

Centralised submission by Collaboration

Presenter name already specified

Primary authors: MORELAND, Scott (Duke University); BERNHARD, Jonah; BASS, Steffen A. (Duke University)

Presenter: MORELAND, Scott (Duke University)

Session Classification: Collectivity in small systems

Track Classification: Collectivity in small systems