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Flavor equilibration of the quark-gluon plasma

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During the early hydrodynamic phase, the chemical composition of the quark-gluon plasma (QGP) is still largely unknown. Here we study the effects of quark chemical equilibration on the QGP using a novel model of viscous hydrodynamic evolution in partial chemical equilibrium. In this model, we initialize the QGP in a completely gluon dominated state, as motivated by the success of gluon saturated initial condition models. Local light and strange quark production during the hydrodynamic phase is simulated through the evolution of time-dependent fugacities for each quark flavor, with the timescales set as free parameters to compare different rates of equilibration. This impacts the system through the equation of state, which we have constructed to depend on the quark flavor content throughout the QGP.

Using this model, implemented in the MUSIC hydrodynamic code and iS3D particlization code, we have simulated ensembles of Pb+Pb and Au+Au collision events with varying quark chemical equilibration times. We discuss the observed dependence of hadronic and electromagnetic observables on the equilibration time. We also examine the impact of quark chemical equilibration on the transport properties of the QGP, and show preliminary results for a Bayesian model-to-data comparison that will simultaneously constrain the equilibration times and transport coefficients of the QGP.

Category

Theory

Collaboration (if applicable)

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