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Determination of QGP initial conditions and medium properties via a Bayesian model to data analysis

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Initial state models translate the spacetime overlap of nuclear density between projectile and target nuclei to generate profiles of entropy (or energy) at the QGP thermalization time which are subsequently evolved by relativistic viscous fluid dynamics. Historically, these initial conditions were generated by one of two means: either from a two-component Glauber ansatz which asserts an admixture of soft and hard collision processes or from specific calculations in Color-Glass Condensate (CGC) effective field theory.

In contrast to the phenomenological approach of the two-component Glauber model where the binary collision fraction is tuned to fit experiment, CGC initial conditions represent predictions calculated from an underlying effective field theory. While modern CGC initial condition models have been highly effective in describing the wealth of bulk observables at RHIC and the LHC, multiple models exist in the literature which predict different results and describe the data with varying degrees of success.

In this talk, we use a parametric initial condition ansatz which mimics the behavior of CGC calculations and extends the coverage of existing two-component parametric mappings to span the full space of reasonable initial condition models. We show that the parameterized initial conditions are highly constrained by bulk observables utilizing Bayesian statistics and a multi-parameter model to data comparison that relies on a state-of-the-art hybrid model for calculating the time-evolution of the QGP phase and its subsequent decay into the hadronic final state. We compare these results to specific calculations in CGC effective field theory and discuss implications for the initial stages of QGP formation.

Collaboration

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