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Bayesian quantification of the Quark-Gluon Plasma from a hybrid model with an IP-Glasma initial state

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We present the first comprehensive Bayesian model-to-data comparison of heavy-ion measurements with IP-Glasma initial conditions, which we combine with state-of-the-art hydrodynamics (MUSIC), particlization (iS3D), and transport simulations (SMASH). By using IP-Glasma initial conditions with varied parameters, we produce a result with a consistent and realistic microscopic physics model for the early stages of heavy ion collisions, allowing us to rigorously address the significant uncertainty from initial conditions. We further introduce a systematically-improvable method for exploring the parameter space of the model for the first time in a nuclear physics study, allowing for a more efficient training of the surrogate model emulator. We obtain improved constraints on the temperature dependence of the QGP viscosities by studying simultaneous use of multiparticle correlation observables, which couple initial state geometry and hydrodynamic evolution. Postdictions and predictions are shown using the newly-obtained Bayesian results. This analysis highlights the importance of using realistic pre-equilibrium dynamics and hydrodynamic evolution to accurately quantify the QGP.

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