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Heavy flavor phenomenology in Pb+Pb collision with IP-Glasma initial state and Bayesian calibrated hydrodynamics

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Heavy quarks serve as effective probes of relativistic heavy-ion collisions as they are created in the initial stages of the collision event and exist at all stages. We study the dynamics of heavy flavors using a hybrid framework that incorporates the MARTINI event generator, pythia8.1 for the initial production of heavy quarks, and Langevin dynamics to describe the evolution of heavy quarks in a 3+1-D expanding QGP medium. We include the interactions of heavy quarks with the medium constituents through the heavy quark transport coefficients. The space-time expansion of the QGP medium is described using the hydrodynamical approach MUSIC with IP-Glasma initial state and Bayesian-quantified viscous coefficients of the strongly-interacting matter. The properties of the QGP medium are probed by analyzing the heavy meson nuclear modification factor and flow coefficient for Pb+Pb collision. In this work utilizing for the first time IP-Glasma fluctuating initial states and hydrodynamics tuned to a global Bayesian analysis, we show that the observables associated with D-mesons are strongly influenced by the IP-Glasma initial state and bulk evolution. Additionally, we provide new insights into the interaction strength of charm quarks in the expanding medium, including elastic collisional processes with medium constituents, gluon emission processes, and non-perturbative interactions.

Category

Theory

Collaboration (if applicable)

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