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Probing the pre-equilibrium stage of heavy-ion collisions with charm quarks

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Charm quarks produced in the initial stages of relativistic heavy-ion collisions serve as crucial probes of the produced medium, including the pre-equilibrium and hydrodynamic stages of the evolution. We simulate relativistic heavy-ion collisions using a hybrid method that integrates a fluctuating IP-Glasma initial state with subsequent viscous hydrodynamics. Utilizing the MARTINI event generator, we simulate the initial production of heavy quarks, and employ Langevin dynamics to model their evolution within the medium. Studying the nuclear modification factor and flow coefficient of D-mesons in Pb+Pb collisions at 5.02 TeV, we focus on the sensitivity to the energy loss of charm quarks during the early stages of the collision. We further explore how charm observables are influenced by the momentum dependence of charm quark energy loss in the medium and the hadronization processes, including fragmentation and coalescence.

Category

Theory

Collaboration

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