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Simulating Charm Quarks in IP-Glasma Initial Stage and Quark-Gluon Plasma: A Hybrid Approach for charm quark phenomenology

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Heavy quarks act as effective probes in relativistic heavy-ion collisions, being generated during the initial phases of the collision event. The accurate modeling of quark-gluon plasma evolution relies on a profound understanding of dynamics in the collision's early phase. We model relativistic heavy-ion collisions at LHC energy with a hybrid dynamical approach consisting of a fluctuating IP-Glasma initial state followed by viscous hydrodynamics.

In this study, we present the first phenomenological findings on charm quark transport spanning from the IP-Glasma initial stage to the quark-gluon plasma. We employed the MARTINI event generator and PYTHIA8.1 to simulate the initial production of heavy quarks and Langevin dynamics to capture the evolution of heavy quarks in the medium. The sensitivity of heavy meson nuclear modification factor and flow coefficient to the early stage of heavy-ion collisions and bulk medium evolution is analyzed for Pb+Pb collision at 5.02 TeV. Our study provides insights into the interaction strength of charm quarks during the early phase and within the quark-gluon plasma.

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