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Impact of Initial State and Energy Loss Models on Heavy-Flavor Azimuthal Correlations in Ultra-Relativistic Collisions

Heavy flavors (charm and beauty) are created via initial hard scatterings in ultra-relativistic heavy-ion collisions. Their early production allows them to experience the entire evolution of the collision. Azimuthal angular correlations of open heavy flavor hadrons with charged particles is an excellent tool to investigate different stages of heavy-ion collisions, as it is sensitive to various stages of the heavy-ion collision.

Heavy quarks propagate through the hot and dense quark-gluon plasma (QGP) medium, losing energy via collisional and radiative processes. Recent studies on initial stages emphasize the importance of a pre-equilibrium glasma phase in understanding heavy flavor dymanics in heavy-ion collision. Although it lasts for less than 1 fm/c, this phase has a significant impact on heavy quark behavior and energy loss before the formation of the quark-gluon plasma (QGP).

This contribution aims to investigate the impact of different initial state and energy loss models on the charm quark via azimuthal angular correlations of D mesons and $^{+}_{c}$ baryons with charged hadrons in pp, and Pb—Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV using the JETSCAPE event generator. The effects of different initial states and energy loss models are quantified by measuring the yield and width of the near side and away side peaks of the azimuthal angular correlation distribution. This study is crucial for drawing robust conclusions regarding heavy quark thermalization and energy loss in the QGP.

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