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Bayesian analysis of the temperature- and momentum-dependence of the heavy flavor diffusion coefficient

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Recent years have seen significant theoretical progress in the transport description of open heavy flavor in QCD matter – a number of models are now able to simultaneously describe a subset of the most important heavy flavor observables – a simultaneous description of a comprehensive set of observables at all available collision energies still poses a challenge. A global analysis encompassing all available collision systems and energies as well as an improved treatment of known uncertainties for different observables would significantly improve our ability to distinguish between different theoretical models and constrain the heavy flavor diffusion coefficient in an unbiased way.

In this study, we show that describing the heavy quark energy loss with Langevin diffusion and a radiative energy loss component in a state-of-the-art hydrodynamic medium, including heavy meson hadronic interactions modeled with UrQMD allows for a simultaneous description of the D-meson R_{AA} and v_n at both RHIC (200 GeV) and the LHC (2.76 \& 5.02 TeV) energies. The heavy flavor interaction with the quark-gluon plasma is encoded in the diffusion coefficient, which is calibrated on experimental measurements using a systematic model-to-data Bayesian analysis. The estimated diffusion coefficient D_sT has a positive temperature dependence and a non-trivial momentum dependence. The constrained diffusion coefficient is validated by comparing D-meson R_{AA} in pPb collisions along with B-meson measurements. New observables are proposed to further constrain the diffusion coefficient.

Content type

Theory

Collaboration

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