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Extract heavy quark transport properties using a linearized-Boltzmann–Langevin model

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Recent progress in open-heavy-flavor measurements and future experimental upgrades are bringing heavy-flavor physics into the precision era, allowing for strong quantitative constraints on the transport properties of heavy quarks in the quark-gluon plasma. On the theory side, it will be imperative to understand the impact of model uncertainty regarding the extraction of heavy-quark transport properties from experimental measurements. A model that suits this purpose is the Lido model, which combines two widely used kinetic approaches: a matrix-element based linearized-Boltzmann transport and diffusion based on the Langevin equation. Heavy quarks undergo both perturbative QCD scattering and non-perturbative diffusive interaction with each of these being a tunable component of the model. We extract the heavy-quark transport coefficients by conducting a Bayesian model-to-data analysis at LHC energies. The impact of modeling uncertainties on the results from the Bayesian calibration are discussed and the extracted transport coefficients are compared to previous calibrations using a radiation-improved Langevin equation.

We also investigate the possibility of absorbing pQCD processes with small momentum transfers to the medium into the diffusion part of the Lido model by restricting the use of pQCD matrix elements processes with large momentum transfers. This study allows us to construct a model that smoothly interpolates between a pure pQCD based approach and a radiation-improved Langevin equation by tuning a single scale parameter, and therefore helps us to further study heavy quark modeling uncertainties in a generalized setup.

Summary

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