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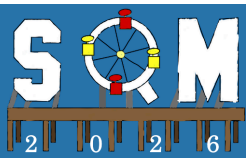

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Nonperturbative Heavy-Flavor Transport Approach for Hot QCD Matter

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Heavy quarks serve as pristine probes of the transport properties and hadronization dynamics of the quark–gluon plasma (QGP) created in high-energy nuclear collisions. A key challenge in this context is to embed the interactions of heavy quarks in the expanding medium compatible with the strong-coupling nature of the QGP, and thus to unravel the underlying microscopic mechanisms. Toward this end, we present a comprehensive framework that employs state-of-the-art treatments of these components.
The transport of heavy quarks in the QGP medium is described by a Langevin-based transport model that has been augmented to incorporate medium-induced radiation. This transport model is coupled to a bulk evolution model based on 2+1D relativistic viscous fluid dynamics. The heavy quark transport coefficients are derived from nonperturbative T-matrix calculations, which account for resonant correlations near the QGP transition temperature. Hadronization of heavy quarks is described by a fragmentation-plus-recombination model. We utilize the resonance recombination model that satisfies 4-momentum conservation and provides an equilibrium mapping between quark and meson distributions. The recombination probabilities are derived from resonant heavy-quark scattering rates.
We report key observables in open heavy flavor physics, including the nuclear modification factor, elliptic flow, baryon-to-meson ratio, as well as D-Dbar angular correlations, and compare our results with experimental data from the RHIC and LHC.

Reference:arXiv:2509.13881

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