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Heavy flavor hadronization and hadron chemistry in heavy-ion collisions

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A solid hadronization model is essential for understanding hadronic observables in high-energy nuclear collisions, while still remains a challenge due to its non-perturbative nature. We have developed an advanced hadronization model for heavy quarks [1] and studied their suppression, flow and hadron chemistry in heavy-ion collisions. A complete set of both s and p-wave hadronic states are included, which naturally cover all major heavy flavor hadron states observed in the Particle Data Group, and normalize the coalescence probability of zero momentum heavy quarks with proper hadron sizes. With a strict energy-momentum conservation implemented, the boost invariance of the coalescence probability and the thermal limit of the produced hadron spectrum are guaranteed.

By combining this newly developed hadronization scheme with the state-of-the-art Langevin-hydrodynamics model [2] that incorporates both elastic and inelastic energy loss of heavy quarks inside the realistic QGP medium, we provide a good description of the nuclear modification factor and elliptic flow of D mesons, as well as the corresponding flavor hierarchy between D and B-decayed electrons. A good description of the charmed hadron chemistry – both p_{T}-integrated and differentiated ${}_c/D^0$ and D_s/D^0 ratios – is also obtained. Our study indicates that the in-medium size of charmed hadrons should be larger than the size in vacuum, which can be tested by hadronic model calculations. It is also found that the inclusion of the p-wave states and the radial flow of the QGP is crucial for understanding the chemical composition of charmed hadrons observed in relativistic heavy-ion collisions.

[1] S. Cao, K.-J Sun, S. Liu, W.-J Xing, G.-Y. Qin and C.-M. Ko, arXiv:1911.00456.
[2] S. Cao, G.-Y. Qin and S.A. Bass (2015) Phys. Rev. C92 024907 (arXiv:1505.01413)

Collaboration (if applicable)

Track

Heavy Flavor and Quarkonia

Contribution type

Contributed Talk

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