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D-meson propagation in hadronic matter and consequences on heavy-flavor observables in ultrarelativistic heavy ion collisions

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Models for the heavy flavor production in ultrarelativistic heavy ion collisions suffer from a lack of elliptical flow as compared to the experimental data if they reproduce $R_{\rm AA}$, often referred to by experimentalists as a "tension between $R_{\rm AA}$ and v_2". One possible reason for this discrepancy may be the disregard of D-meson rescattering in hadronic matter in the latest stage of the evolution. To study this is the core of our contribution.

The drag and diffusion coefficients of D-mesons propagating in a hot and dense hadronic matter are calculated. The hadronic medium consists of pions, kaons, etas, rho-mesons and nucleons. We find that the transport coefficients increase with the temperature of the medium. The dominant contributions to the drag and diffusion coefficients come from pions, but at higher temperatures the contributions from other (heavier) hadrons become important as well. In addition, we evaluate the thermal relaxation rate of D-mesons, which is in agreement with the model estimate of He, Fries and Rapp. The relaxation rate reaches approx. 0.1/fm in the vicinity of the critical temperature; this is comparable to non-perturbative T-matrix calculations of charm-quark relaxation in QGP. The size of the transport coefficients in hadronic matter shows that the hadronic contributions should be included when evaluating the nuclear suppression factor and the elliptic flow for single leptons originating from the decays of D-mesons or for D-mesons during the expansion of the matter created in heavy ion reactions at mid-rapidity.

Finally, we study the consequence for the $R_{\rm AA}$ and v_2 of heavy mesons by using a hydrodynamical model for the expansion of QGP and the hadron gas in which the chemical freeze-out is modelled by the effective chemical potential. We present the modification of the $R_{\rm AA}$ and v_2 of D-mesons due to the hadronic rescattering, for both, RHIC and LHC energies.

On behalf of collaboration:

None

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