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Heavy quark dynamics in heavy-ion collisions

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We study charm and bottom production in ultra-relativistic heavy-ion collisions by using the Parton-Hadron-String Dynamics (PHSD) transport approach.
The charm and bottom quarks are produced through initial binary nucleon-nucleon collisions by using the PYTHIA event generator taking into account the (anti-)shadowing incorporated in the EPS09 package. The produced heavy quarks interact with off-shell massive partons in the quark-gluon plasma and are hadronized into D and B mesons through coalescence or fragmentation close to the critical energy density, and then interact with hadrons in the final hadronic stage with scattering cross sections calculated in an effective Lagrangian approach with heavy-quark spin symmetry. The PHSD results show a reasonable R_{AA} and elliptic flow of D mesons in comparison to the experimental data for Au+Au collisions at $\sqrt{s_{NN}}$ =200 GeV from the STAR Collaboration as well as for Pb+Pb collisions at $\sqrt{s_{NN}}$ =2.76 TeV from the ALICE Collaboration.
Also we obtain a good description of the PHENIX data on R_{AA} and v_2 of a single electron when including the feed back from the B-meson decay which is important at large p_T.
We find that in the PHSD the energy loss of D mesons at high p_T can be dominantly attributed to partonic scattering while the actual shape of R_{AA} versus p_T reflects the heavy-quark hadronization scenario, i.e. coalescence versus fragmentation. Also the hadronic rescattering is important for the R_{AA} at low p_T and enhances the D-meson elliptic flow v_2.
We also study the effect of temperature-dependent off-shell charm quarks in relativistic heavy-ion collisions. We find that the scattering cross sections are only moderately affected by off-shell charm degrees of freedom. However, the position of the peak of R_{AA} for D mesons depends on the strength of the scalar partonic forces which also have an impact on the D meson elliptic flow. The comparison with experimental data on the R_{AA} suggests that the repulsive force is weaker for off-shell charm quarks as compared to that for light quarks. Furthermore, the effects from radiative charm energy loss appear to be low compared to the collisional energy loss up to transverse momenta of ˜ 15 GeV/c.

On behalf of collaboration:

None

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