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# Tomography of the Quark-Gluon-Plasma by Charm Quarks

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The charm production in ultra-relativistic heavy-ion collisions is studied based on the Parton-Hadron-String Dynamics (PHSD) transport approach. The initial charm quarks are produced by the Pythia event generator tuned to fit the transverse momentum spectrum and rapidity distribution of charm quarks from Fixed-Order Next-to-Leading Logarithm (FONLL) calculations. The shadowing effect is accounted for the nuclei collisions. The produced charm quarks scatter in the quark-gluon plasma (QGP) with the off-shell partons whose masses and widths are given by the Dynamical Quasi-Particle Model (DQPM), which reproduces the lattice QCD equation-of-state in thermal equilibrium. The relevant cross sections are calculated in a consistent way by employing the effective propagators and couplings from the DQPM. Close to the critical energy density of the phase transition, the charm quarks are hadronized into $D$ mesons through coalescence and fragmentation. The hadronized $D$ mesons then interact with the various hadrons in the hadronic phase with cross sections calculated in an effective lagrangian approach with heavy-quark spin symmetry. The nuclear modification factor $R_{AA}$ and the elliptic flow $v_2$ of $D^0$ mesons from PHSD are compared with the experimental data from the STAR Collaboration for Au+Au collisions at $\sqrt{s_{NN}}$ =200 GeV and to the ALICE data for Pb+Pb collisions at $\sqrt{s_{NN}}$ =2.76 TeV. 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 $v_2$.

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## On behalf of collaboration:

NONE

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