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Probing charm production in high-energy nuclear collisions

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Lattice QCD predicts that, above a certain critical energy density or temperature, strongly interacting matter undergoes a phase transition from the hadronic world to a quark-gluon plasma state, where the colored quarks and gluons are no longer bound to colorless hadrons.
The suppression of quarkonium production in high-energy nuclear collisions is one of the most interesting signatures of QGP formation, for two reasons: due to their large masses, charm and beauty quarks are created only in the initial hard scattering processes, before the QGP is formed; and the Q-Qbar binding potential should be screened in the deconfined color medium.
Until the LHC starts colliding Pb nuclei, charm is the heaviest quark that can check the validity of the finite temperature QCD predictions, given the much smaller beauty production cross sections. However, the interpretation of the presently available results on charmonium suppression, obtained at the SPS and RHIC, is hampered by a multitude of other "nuclear effects".
Measurements of the D meson production yield and its dependency on collision centrality and energy are very valuable in this context. In particular, the ratio between the J/psi and the DDbar production yields is insensitive to initial state effects, such as the very badly known nuclear modifications of the gluon distribution functions and the energy loss of the partons which interact to produce the c-cbar pair.
However, it is exceedingly difficult to reconstruct the hadronic decays of the D mesons in the high-density track environment of a high-energy nuclear collision. This explains why almost all available experimental data on charm production in heavy-ion collisions comes from studies of correlated semi-leptonic decays of pairs of charmed mesons.
This talk will review the available SPS and RHIC open charm measurements, expose the respective puzzles, and discuss some paths towards their solution.

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