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Towards the dynamical study of heavy-flavour quarks in the Quark-Gluon-Plasma

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The aim of this project is to study the properties of the QGP produced in relativistic heavy-ion collisions (HIC) using heavy quarks - charm and beauty (c, b) - as penetrating probes. The heavy quarks (and correspondingly charm and beauty mesons) are considered to be one of the best probes for such a study since due to their large mass they are produced dominantly by hard processes during the early stage of the reaction when the QGP is formed; traversing the plasma they do not come into equilibrium with the environment since their interaction with the partons is probably not strong enough.

Our study of charm dynamics in HIC is based on the existing microscopic PHSD (Parton-Hadron-String Dynamics) transport approach [1] which incorporates explicit partonic degrees-of-freedom in terms of strongly interacting quasiparticles (quarks and gluons) in line with an equation-of-state from lattice QCD as well as the dynamical hadronization and hadronic collision dynamics in the final reaction phase.

The evaluation of scattering cross sections of heavy quarks with the QGP quasiparticles represents the first step of this study.

In our contribution, we will present the elastic scattering cross section of heavy quarks with partons in vacuum and in the QGP medium [2] at finite temperature and chemical potential. We will, furthermore, present our evaluation of the transport coefficients, employing this cross section and discuss the dynamical collisional energy loss of heavy quarks in the QGP. Our results show clearly the effect of finite temperature and chemical potential on the perturbative heavy quark cross section, transport coefficients and collisional energy loss [2, 3].

[1] W. Cassing, and E. L. Bratkovskaya, "Parton-Hadron-String Dynamics: an off-shell transport approach for relativistic energies", Nucl. Phys. A831 (2009) 215-242.

[2] H. Berrehrach, P.B. Gossiaux, J. Aichelin, E. Bratkovskaya, W. Cassing and M. Bleicher, "Collisional processes of heavy quarks in vacuum and in the QGP medium", in preparation.

[3] H. Berrehrach, E. Bratkovskaya, W. Cassing, P.B. Gossiaux and J. Aichelin, "Interaction rates, dynamical collisional energy loss and transport coefficients of heavy quarks in vacuum and in the QGP medium", in preparation.

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