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Formation, dissociation and regeneration of charmonia within microscopic Langevin simulations

We present a microscopic model to study the formation, as well as dissociation and recombination processes of charmonium states in the quark gluon plasma. In this classical approach, heavy quarks are described as Brownian particles in a background medium of light constituents. The heavy-quark dynamics are modelled by a Fokker-Planck equation with constant transport coefficients, which is then implemented through relativistic Langevin simulations. The heavy quarks interact classically via a Coulomb-like screened potential, enabling the formation of charmonium states. These bound states may dissociate due to screening effects of the potential and through scatterings with plasma particles. Using box simulations at fixed temperature and volume, we demonstrate the full equilibration of the system with equilibrium charmonium yields consistent with the Statistical Hadronization Model. In order to model the phenomenology of a heavy-ion collision, we then implement a dynamical description, where the evolution of the expanding medium is parametrized by a boost invariant fireball. This allows us to study the elliptic flow and nuclear modification factor of the charm and anticharm quarks, as well as of charmonia, at RHIC and LHC energy, and compare the results to experimental data.

Category

Theory

Collaboration (if applicable)

Authors: GREINER, Carsten (University of Frankfurt); Dr VAN HEES, Hendrik; TORRES-RINCON, Juan (Universitat de Barcelona); OEI, Naomi

Presenter: OEI, Naomi

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