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The influence of initial conditions on the final observables for heavy-ion collisions at RHIC energies

Every dynamical description of heavy-ion collisions –whether based on hydrodynamics or on a parton cascade– starts out with the modeling of the 'initial condition', i.e. the state of the system after the first initial energetic collisions between target and projectile nucleons. Usually it is assumed that the whole system or at least the quark-gluon plasma comes to a thermal equilibrium after 1fm/c and then hydrodynamics can be employed.

We present a systematic study of the influence of the initial conditions on the final observables for heavy-ion reactions by investigating this reaction for different intial conditions with the novel molecular dynamics (MD) transport approach based on the the Nambu-Jona-Lasinio (NJL) model. The NJL Lagrangian whose parameters are adjusted to properties of free mesons and their decay constants allows for a description of the expansion of a quark-antiquark plasma whose constituents interact by potential and collisional interactions. It describes as well the transition of the plasma to the hadronic world.

For our comparison we use a 'smooth' initial conditions of the Glauber type as well as the 'lumpy' energy density profile from the microscopic PHSD (Parton-Hadron-String-Dynamics) transport approach which incorporates the hadronic and partonic interactions. For these different initial conditions we present the results for the transverse differential spectra dN/dpt and the elliptic flow v2 for Au+Au at RHIC energies. We analyse furthermore the origin of these differences and whether the experimental spectra allow for a conclusion about the structure of the initial conditions.

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