

Why the hydrodynamics is valid at early stage of heavy-ion collisions?

Friday, 26 October 2018 16:50 (20)

We study equilibration of hot and dense nuclear matter produced in relativistic heavy-ion collisions within two microscopic transport models, UrQMD and QGSM. Both models indicate that the state of kinetic, thermal and chemical equilibrium is nearly approached at any collision energy after a certain relaxation period. The hydrodynamic scenario is based on the assumptions of fast equilibration and almost isentropic expansion of the matter. Then, it employs the equation of state (EOS) which links pressure to energy density. Microscopic calculations show that (i) the matter expands with the constant entropy-per-baryon ratio and (ii) with the constant pressure to energy density ratio already at very early times, when the matter is not in local chemical and thermal equilibrium yet. Both findings justify the application of hydrodynamic description to early stages of heavy-ion collisions.

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Session Classification : Heavy Ion Physics

Track Classification : Nuclear physics: heavy ion