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Effective kinetic description of event-by-event pre-equilibrium dynamics in high-energy heavy-ion collisions

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We develop a macroscopic description of the space-time evolution of the energy momentum tensor during the pre-equilibrium stage of a high-energy heavy-ion collision. Based on a weak coupling effective kinetic description of the microscopic equilibration process (a la "bottom-up"), we calculate the non-equilibrium evolution of the local background energy-momentum tensor as well as the non-equilibrium linear response to transverse energy and momentum perturbations for realistic boost-invariant initial conditions for heavy ion collisions. We demonstrate that this framework can be used on an event-by-event basis to propagate the energy momentum tensor from far-from-equilibrium initial state models, e.g. IP-Glasma, to the time τ_{hydro} when the system is well described by relativistic viscous hydrodynamics. We show that with kinetic theory pre-equilibrium, the final hadron multiplicities and radial and elliptic flows become essentially independent of the hydrodynamic initialization time τ_{hydro}. The effective kinetic description of the pre-equilibrium evolution can be also used for studying the chemical equilibration of quarks and gluons and the pre-equilibrium photon production.

Content type

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