

How does relativistic kinetic theory remember about initial conditions?

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Understanding hydrodynamization in microscopic models of heavy-ion collisions has been an important topic in current research. Many lessons obtained within the strongly-coupled (holographic) models originate from the properties of transient excitations of equilibrium encapsulated by short-lived quasinormal modes of black holes. The aim of this talk is to develop similar intuition for expanding plasma systems described by, perhaps, the simplest model from the weakly-coupled domain, i.e. the Boltzmann equation in the relaxation time approximation. I will show that in this kinetic theory setup there are infinitely many transient modes carrying at late times the vast majority of information about the initial distribution function. They all have the same exponential damping set by the relaxation time but are distinguished by different power-law suppressions and different frequencies of very slow, logarithmic in proper time, oscillations. Finally, I will analyze the resurgent interplay between the hydrodynamics and transients. In particular, I will show that there are choices of relaxation time dependence on temperature for which the asymptotics of the divergent hydrodynamic series is dominated not by the least damped transient, but rather by an unphysical exponential correction having to do with non-analyticities of the equation of motion in complexified time variable.

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