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Hydrodynamics far-from-equilibrium: a concrete example in kinetic theory

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Fluid-dynamical models have been applied with success to describe the hot and dense QCD matter produced in ultra-relativistic heavy ion collisions at RHIC and LHC. However, the applicability of such models in the extreme conditions produced in heavy ion collisions has not yet been properly understood from a theoretical point of view. This happens mostly because the derivation of hydrodynamics from microscopic theory often relies on the assumption that the system is sufficiently close to equilibrium -- something difficult to justify in the rapidly expanding systems created in heavy ion collisions. In this seminar we discuss the microscopic origins of relativistic fluid dynamics from kinetic theory. We demonstrate that, for a wide variety of nonequilibrium states, a hydrodynamic theory that is identical to the traditional hydrodynamic equations applied to heavy ion collisions can be obtained.