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Dissipative dynamics of highly anisotropic plasmas

We present a method to improve the description of 0+1 dimensional boost invariant dissipative dynamics in the presence of large momentum-space anisotropies. Instead of using the canonical hydrodynamical expansion of the distribution function around an isotropic equilibrium state, we expand around a state which is anisotropic in momentum space and parameterize this state in terms of three proper-time and spatial-rapidity dependent parameters. At leading order the result obtained is two coupled hydro-like differential equations for the momentum-space anisotropy and typical momentum of the degrees of freedom. Within this framework, we get both the ideal hydrodynamic and free streaming expansion as asymptotic limits. In addition, we show that when linearized the differential equations reduce to 2nd order Israel-Stewart viscous hydrodynamics. Finally, we make quantitative comparisons of the evolution of the pressure anisotropy within our approach and 2nd order viscous hydrodynamics in both the strong and weak coupling limits. We make quantitative comparisons of the evolution of the pressure anisotropy within our approach and 2nd order viscous hydrodynamics in both the strong and weak coupling limits. Finally, we comment about the generalization of this framework to non-boost invariant expansion.

Primary author: Dr MARTINEZ GUERRERO, Mauricio (FIAS)

Co-author: Dr STRICKLAND, Michael (Gettysburg College)

Presenter: Dr MARTINEZ GUERRERO, Mauricio (FIAS)

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