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Dissipative hydrodynamics for relativistic multi-component systems

Novel set of second-order dissipative hydrodynamic equations for shear stress tensor of each component of a multi-component mixture is derived using the entropy principle [1]. Summation over the equations for all components leads to an effective relaxation-type one-component equation for the total system. In this equation the effective shear viscosity (or alternatively the η/s ratio) of the whole system is related to the partial shear pressures and cannot be considered as an external parameter. We demonstrate that in order to describe hydrodynamic behaviour of a multi-component system as a whole it is essential to solve hydrodynamic equations for each component, instead of treating a mixture as an effective one-component system with the free parameters η/s and initial time [1]. This conclusion is confirmed by comparisons of solutions of the new hydrodynamic equations with results of kinetic transport simulations, which demonstrate a very good agreement between the two approches. Thus, extractions of the η/s value of the QGP at RHIC and LHC have to be reexamined. We apply the obtained multi-component hydrodynamic equations to quantify the dissipative effects on quark and gluon spectra, which are relevant for coalescence and recombination models of hadronization.

[1] A. El, I. Bouras, F. Lauciello, Z. Xu and C. Greiner
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