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Viscous anisotropic hydrodynamics for the conformal Gubser flow

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In this work we describe the dynamics of a highly anisotropic system undergoing a boost-invariant longitudinal and azimuthally symmetric radial expansion (Gubser flow) for arbitrary shear viscosity to entropy density ratio. We derive the equations of motion of dissipative anisotropic hydrodynamics by considering the moments method recently derived by Molnar et al. (MNR), Phys. Rev. D 93, 114025 (2016) and arXiv:1606.09019, based on an expansion around an arbitrary anisotropic one-particle distribution function. In order to close the conservation laws, it is needed to choose an additional moment of the Boltzmann equation. This is achieved by selecting the relaxation equation for the longitudinal pressure with a suitable Landau matching condition. As a result one obtains two coupled differential equations for the energy density and the longitudinal pressure which respect the $SO(3)_q \otimes SO(1,1) \otimes Z_2$ symmetry of the Gubser flow in the deSitter space. These equations are solved numerically and compared with the predictions of the recently found exact solution of the relaxation-time-approximation Boltzmann equation subject to the same flow. We also compare our numerical results with other fluid dynamical models. We observe that the MNR description of anisotropic fluid dynamics describes better the space-time evolution of the system than all currently known hydrodynamical approaches.

Preferred Track

Collective Dynamics

Collaboration

Not applicable

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