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Analytical and numerical Gubser solutions of the second-order hydrodynamics

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Evolution of quark-gluon plasma (QGP) near equilibrium can be described by the second-order relativistic viscous hydrodynamic equations. Consistent and analytically verifiable numerical solutions are critical for phenomenological studies of the collective behavior of QGP in high-energy heavy-ion collisions. A novel analytical solution based on the conformal Gubser flow which is a boost-invariant solution with transverse fluid velocity is presented. Due to the non-linear nature of the equation, the analytical solution is non-perturbative and exhibits features that are rather distinct from solutions to usual linear hydrodynamic equations. It is used to verify with high precision the numerical solution with a newly developed state-of-the-art (3+1)-dimensional second-order viscous hydro code (CLVisc). The perfect agreement between the analytical and numerical solutions demonstrates the reliability of the numerical simulations with the second-order viscous corrections. This lays the foundation for future phenomenological studies that allow one to gain access to the second-order transport coefficients.

On behalf of collaboration:

NONE

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