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New perturbative solutions for relativistic hydrodynamics and the effect of longitudinal acceleration on spectra

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In this work, we aim to investigate analytical solutions which take into account the longitudinal acceleration effect of fluid dynamics for nucleus-nucleus collisions. Starting from the equations for dissipative fluid dynamics, a new perturbative analytical solution for $1 + d$ dimensional accelerating relativistic viscous hydrodynamics is presented.
From this accelerating hydrodynamic theory, the solution not only contains the general first-order viscous construct, but also includes a longitudinal acceleration parameter. The results show that, with the longitudinally accelerating hydrodynamic expansion, the temperature gradient becomes larger due to the acceleration effect, meanwhile the viscous corrections will decelerate the longitudinal hydrodynamic expansion and make the cooling rate smaller. Numerical results on the transverse momentum spectra, rapidity spectra and pseudo-rapidity spectra in the final state, are given for different values of the acceleration parameter, shear (bulk) viscosity to entropy density ratio η/s (ζ/s), and speed of sound c_s.

Content type

Theory

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