

# On the convergence of the gradient expansion of the Boltzmann equation

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When two heavy nuclei collide in relativistic heavy ion collisions, the resulting system is initially in a non-equilibrium state. The evolution of the system towards equilibrium can be studied by using the Boltzmann equation. However, approximating the solution to the Boltzmann equation using a gradient expansion leads to a divergent series. Using an integral solution to the Boltzmann equation in relaxation time approximation, we obtain its full gradient expansion which contains exponentially decaying non-hydrodynamic terms. It is shown that this gradient expansion can have a finite radius of convergence. We further argue that, in the relaxation time model, proximity to local thermal equilibrium is not necessary for the system to be described by hydrodynamic equations.

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