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Analytical Solution of the Relativistic Boltzmann Equation

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We provide an exact analytical solution to the nonlinear relativistic Boltzmann equation for a homogeneous, anisotropically scattering massless gas. Utilizing a BKW-like trial solution, we cast the Boltzmann equation into a set of nonlinear coupled equations for scalar moments, based on which the analytical solution is derived. We also show that this analytical solution admits a stable fixed point corresponding to the equilibrium solution as long as the parameters are physically feasible. Furthermore, a clear correspondence between our solution and the BKW solution pertaining to nonrelativistic Maxwell molecules is established, thereby clarifying the non-existence of a BKW- type solution in the relativistic domain for massive particles.

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