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The freezeout procedure with the method of moments

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The method of moments has been employed to derive relativistic fluid-dynamical theories from the Boltzmann equation for the past decades [1]. This approach consists in expanding the single-particle distribution function using a basis of irreducible momenta, where the expansion coefficients are the irreducible moments of the nonequilibrium distribution function [2]. Unlike the Chapman-Enskog method [3], it has the advantage of yielding formulations that might be causal and stable, provided the transport coefficients satisfy certain constraints [4]. However, so far, only the equations of motion for the hydrodynamic moments have been explicitly calculated, with the equations of motion for the moments of rank 3 and 4 being calculated recently, in Ref. [5]. In this contribution, we address this problem by systematically calculating the general equations of motion for all irreducible moments and show how they can be used to solve the Boltzmann equation itself. Since this method of solving the Boltzmann equation does not rely on resolving particle degrees of freedom, it can be used to provide a more consistent description of the freezeout process that does not require a particlization procedure. We investigate this prescription in a Bjorken flow scenario and investigate with detail the transition from a fluid description to a transport one.

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Category

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