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AMY Lorentz invariant parton cascade

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The observation of signs of collectivity in small systems has highlighted the need for a better understanding of equilibration in small and large collisions systems. In search of this, the QCD effective kinetic theory formulated by Arnold, Moore and Yaffe (AMY) [1] has emerged as a promising candidate. In order to fully exploit the theory also for phenomenology we introduce ALPACA [2], a Lorentz invariant parton cascade which is a representation of the AMY effective kinetic theory in the form of a Monte Carlo event generator. It solves the Boltzmann equation with the full AMY kernels (elastic scattering and splitting/merging processes) by explicitly simulating the evolution of parton ensembles corresponding to single events. It is constructed in a fully Lorentz invariant way by using a method pioneered in [3], which also underlies the parton cascade PCPC [4]. A complication arises from quantities like the screening mass, that enter the AMY kernels and are defined as integrals over the phase space densities. We develop a method for extracting these locally from the parton ensemble without the need for further information. We perform an extensive validation of the framework in thermal equilibrium and present first results for out-of-equilibrium simulations for collisions of light nuclei down to protons. Here we focus on harmonic flow response to initial geometry deformations and the question to what extent such systems equilibrate.

[1] P. B. Arnold, G. D. Moore and L. G. Yaffe, JHEP 01 (2003), 030 [arXiv:hep-ph/0209353 [hep-ph]]
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Category

Theory

Collaboration (if applicable)

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