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Pre-hydrodynamic evolution and conformal symmetry in small systems

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The pre-hydrodynamic evolution of a heavy-ion collision can have important effects on final state observables, and has received significant renewed interest. Here, we utilize a state-of-the-art simulation chain of heavy ion collisions to extend our previous investigation on the effects of pre-hydrodynamic evolution on final-state observables to small systems. Our simulations include different pre-hydrodynamic scenarios, but which all share an underlying assumption of scale invariance, a common and ubiquitous approximation. This assumption artificially generates a large out-of-equilibrium bulk pressure when switching from (conformal) pre-hydrodynamic evolution to hydrodynamics (via the non-conformal QCD equation of state), increasing the system transverse momentum, masking other pre-hydro effects, and ultimately poisoning transportcoefficients extracted under these models. We investigate the extent to which these effects are present for small systems compared to large systems, reinforcing the need for the use of improved, non-conformal models for early time dynamics.

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