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Rapidity Dependence of Transverse Momentum Correlations

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Experiments demonstrate the profound effect of initial state fluctuations in nuclear collisions, but theory demands that further fluctuations arise and are dissipated throughout the subsequent hydrodynamic evolution. Our earlier work shows that viscous dissipation broadens the rapidity dependence of two-particle transverse momentum correlations [1]; this work stimulated an experimental analysis by STAR [2]. That analysis uncovered puzzling new features in the detailed rapidity dependence of these correlations. We present new work on correlation observables computed using the second order Israel-Stewart hydrodynamics with stochastic noise and latest lattice QCD equations of state and transport coefficients. We also compute these observables using the first order Navier-Stokes theory. We find that the second order theory with causal constraints is needed to explain the new features uncovered by the experiment.

[1] S. Gavin and M. Abdel-Aziz, Phys.Rev.Lett. 97 (2006) 162302; M. Sharma et al. Phys.Rev. C84 (2011) 054915.
[2] STAR Collab., Phys.Lett. B704 (2011) 467-473.

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