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Observable consequences of partial thermalization in relativistic nuclear collisions

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The discovery of flow-like azimuthal correlations in pA and high-multiplicity pp collisions raises profound questions about the onset of collective flow and its relation to hydrodynamics. We seek independent experimental information on the degree of thermalization in order to identify those hydrodynamic collision systems in which flow is sensitive to equilibrium QCD properties. We aim to develop a protocol for identifying the degree of thermalization using a combination of momentum and multiplicity correlation. To study the effect of thermalization on these correlations, we use Boltzmann equation in the relaxation time approximation with Langevin noise. We derive a new non-equilibrium transport equation for the two-body distribution function that is consistent with the conservation laws obeyed by microscopic scattering processes. We find that transverse momentum fluctuations in peripheral PbPb collisions at LHC markedly deviate from equilibrium behavior. We propose new measurements that can provide more refined information. *This work is supported in part by NSF-PHY1913005 (G.M.)

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