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Decorrelation of anisotropic flow along the longitudinal direction

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The decorrelation of 2nd and 3rd order anisotropic flow along longitudinal direction with large pseudorapidity η gap is investigated in event-by-event (3+1)D ideal hydrodynamics with fluctuating initial conditions from A MultiPhase Transport (AMPT) model. The agreement between our results and CMS data for all available centralities in Pb+Pb collisions at LHC suggests that the string model used in Pythia and Hijing captures most features of the initial state fluctuations along longitudinal direction. The predictions for Au+Au collisions at RHIC are provided and give a much stronger longitudinal decorrelation, indicating larger fluctuations along the pseudorapidity direction for lower energy collisions. Further detailed studies show that the decorrelation of final charged hadrons in momentum space comes from initial state decorrelation in space, while the hydrodynamic evolution is important to transfer the decorrelation in coordinate space to momentum space. We also demonstrate that this breakdown of the flow factorization is an important ingredient towards understanding the longitudinal structure in the initial state of high energy heavy ion collisions.

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