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Collective flow in small systems from an integrated dynamical model

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Whether hydrodynamic flow is generated in small systems such as p+Pb collisions at LHC and d+Au collisions at RHIC is hotly debated open problem. We analyze these systems by employing a fully 3-dimensional integrated dynamical model [1] in which an initial model with various kinds of fluctuations, hydrodynamic QGP evolution and hadronic transports are incorporated. For this purpose, we develop a novel type of hydrodynamic initialization model by combining an event generator, PYTHIA [2], Brodsky-Gunion-Kuhn type initial nuclear effects [3] and MC-Glauber model. In addition to the fluctuation of transverse profile having been discussed frequently so far, this newly developed model enables us to demonstrate multiplicity fluctuation, longitudinal fluctuations and highly asymmetric longitudinal profile, which have not been available in the conventional MC-Glauber model. Since the size of the system is small and, in turn, the lifetime of the QGP fluid is short, the hadronic afterburner must play a major role in the whole dynamical evolution. So we investigate this by switching on/off the hadronic rescatterings in the integrated dynamical model so that we can quantify how much the hydrodynamic evolution of the QGP is attributed for the observed collective-flow-like behaviors in the experimental data.

[1] T. Hirano et al., Prog. Part. Nucl. Phys. 70, 108 (2013).
[2] T. Sjöstrand et al., Comput. Phys. Commun. 191, 159 (2015).
[3] S.J. Brodsky, J.F. Gunion and J.H. Kuhn, Phys. Rev. Lett. 39, 1120 (1977).

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