

Reinterpretation of higher harmonics from mini-jet propagation

We investigate effects of mini-jet propagation on collective expansion of the quark gluon plasma (QGP) and, based on this picture, reinterpret higher harmonics (v_n) data in Pb+Pb collisions at the LHC energies.

In ultrarelativistic heavy ion collisions, a large number of mini-jets are subject to traverse the QGP and are expected to disturb its collective expansion due to deposition of energy and momentum from them. Thus, we focus on hydrodynamic responses to propagation of a large number of mini-jets in the QGP.

We employ a QGP fluid + jet model [1,2] to demonstrate the above idea. We solve (3+1)-dimensional ideal hydrodynamic equations with energy-momentum source terms.

As an input, we generate partons by using an event generator PYTHIA with switching off hadronization, combined with a Monte-Carlo version of the Glauber model.

Instead of setting initial conditions for hydrodynamic fields, we make these partons propagate until hydrodynamic initial time and, during this stage, they deposit energy and momentum locally.

We suppose these deposited energy and momentum are quickly equilibrated to form initial hydrodynamic fields.

Although this is rather phenomenological treatment of thermalization/equilibration, this naturally generates not only initial fluctuations of geometry but also those of velocity fields which are often neglected in the conventional hydrodynamic analysis.

Subsequently we consider survived partons as mini-jets and simulate hydrodynamic responses to mini-jet propagation.

We find mini-jet propagation indeed causes sizable anisotropic flow in the QGP fluid. This suggests conventional hydrodynamic interpretation of flow data based solely on initial eccentricity should be revisited by taking account of correction from mini-jet propagation and initial random velocity fields.

References

[1] Y.Tachibana and T.Hirano,
“Momentum transport away from a jet in an expanding nuclear medium,”
Phys. Rev. C , no. 2, 021902 (2014)

[2] Y.Tachibana and T.Hirano,
“Interplay between Mach cone and radial expansion and its signal in γ -jet events,”
Phys. Rev. C , no. 5, 054907 (2016)

Preferred Track

Collective Dynamics

Collaboration

Not applicable

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Session Classification: Poster Session