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QGP properties from azimuthal-angular dependence of charged-pion interferometry

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Recently the results of HBT measurements of charged pions with respect to the second and third order event plane are presented by PHENIX [1]. They extract ϵ_2 and ϵ_3 from the HBT measurements which contain information about not only the source shape at freezeout but also the space-time evolution of QGP matter. They show the relation between initial $\epsilon_{2,3}$ which are obtained from a Glauber model and final $\epsilon_{2,3}$ which are extracted from the HBT radii. They find that the final ϵ_2 from the HBT radii is finite and smaller than the initial ϵ_2. On the other hand, the final ϵ_3 is significantly reduced and potential reversed by the end in spite of existence of finite initial ϵ_3. The interesting different response of ϵ_2 and ϵ_3 during space-time evolution gives us a clue to understand the detailed QGP properties.

For analyses of such high statistics experimental results, we develop a state of the art numerical scheme of causal viscous hydrodynamics for relativistic heavy ion collisions, which has a shock-wave capturing scheme and less numerical dissipation [2]. Furthermore, using the hydrodynamic algorithm, we construct a hybrid model of hydrodynamic model plus UrQMD to include the realistic freezeout processes. Using the model we investigate the time evolution of spatial anisotropies ϵ_n. We find that the sign of ϵ_3 changes from positive to negative during the space-time evolution, which suggests a solution of the vanishing final ϵ_3 from the HBT radii by PHENIX. From detailed analyses, we discuss the initial conditions of hydrodynamic model and the detailed QGP properties such as transport coefficients.

[1] A.Adare et al. [PHENIX collaboration], Phys. Rev. Lett. 222301 (2014).
[2] Y. Akamatsu, S. Inutsuka, C. Nonaka, M. Takamoto, J. Comp. Phys. (2014), pp. 34-54; K.Okamoto, Y.Akamatsu, C.Nonaka, in preparation.

On behalf of collaboration:

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