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Effects of hydrodynamic fluctuations on azimuthal flow in ultra-central heavy-ion collisions

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It is reported recently that an intriguing behavior of the anisotropic flow coefficients in ultra-central Pb-Pb collisions at the LHC. Elliptic flow in ultra-central collisions is driven mainly by fluctuations rather than collision geometry. Therefore, magnitudes of elliptic flow and triangular flow coefficients are almost identical. Some hydrodynamic models, which have been successful in describing non-central data, fail to reproduce elliptic flow and triangular flow coefficients simultaneously in ultra-central collisions. We try to resolve the issue by investigating effects of hydrodynamic fluctuations on anisotropic flow coefficients in ultra-central collisions.
We employ an integrated dynamical model [1] to describe the dynamics of heavy-ion collisions at the LHC energy. Here, we introduce hydrodynamic fluctuations into relativistic hydrodynamic model through the fluctuation-dissipation theorem [2]. Hydrodynamic fluctuations are thermal fluctuations during hydrodynamic evolution. Since anisotropic flow is driven mainly by fluctuations in ultra-central collisions, hydrodynamic fluctuations play an important role in understanding their coefficients. The gap between magnitudes of elliptic flow and triangular flow is expected to decrease because hydrodynamic fluctuations enhance higher order flow coefficients more effectively. Setting impact parameter to be vanished to remove geometric effects, we first compare the results with hydrodynamic fluctuations and without them. Next, we analyze the effect of hydrodynamic fluctuations on azimuthal flow in ultra-central collisions. We also analyze the correlation between initial transverse eccentricity ε_n and final anisotropic flow v_n in ultra-central collisions.

[1] T. Hirano et al., Prog. Part. Nucl. Phys. 70 (2013) 108.
[2] K. Murase, Ph. D thesis, The University of Tokyo (2015)

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