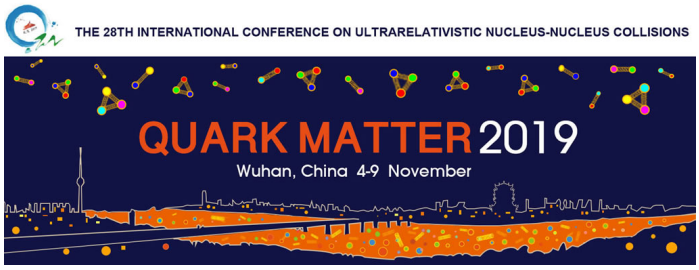

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One fluid may not rule them all

Wednesday, 6 November 2019 15:40 (20 minutes)

Anisotropic flow is a useful observable to quantify the transport properties of the Quark Gluon Plasma (QGP) produced in heavy-ion collisions and to probe the hydrodynamic flow in small collision systems e.g. proton-proton (pp) and proton-lead (p–Pb) collisions. The experimental observed "correct" signs of multi-particle cumulants of v_n coefficient in small collision systems, in particular, the negative sign of $c_2\{4\}$, are usually interpreted as the signature of hydrodynamic flow. In this talk, I present the investigations on 2- and multi-particle cumulants in high-multiplicity pp collisions, using iEBE-VISHNU hybrid model with HIJING initial condition. Although the model with tuned parameters could nicely describe almost all experimental measurements of two-particle correlations, however, it could not generate the negative $c_2\{4\}$. In addition, I will show that this positive $c_2\{4\}$ in hydro is not caused by possible non-flow contributions (resonances decay), multiplicity fluctuations (fake flow) or the multi-particle cumulant method itself (statistical stability). Further investigations by replacing HIJING initial conditions with super-MC and TRENTo initial conditions, and by including pre-equilibrium effects and kinetic theory, can not have the ability to reproduce the observed negative $c_2\{4\}$. It is also seen that the hydrodynamic evolution generates an additional non-linear (cubic) response of v_2 to initial eccentricity ε_2, which results in a positive $c_2\{4\}$ despite the negative $\varepsilon_2\{4\}$ obtained in the first place.

Two new questions then appear, whether the success of hydrodynamic calculations in 2-particle correlations and failure of hydrodynamic descriptions of multi-particle cumulants requires a novel understanding of initial conditions or the one fluid may not rule them all. In this talk, together with the new calculations from AMPT transport model with various scenarios and also PYTHIA model (with and without color reconnection, with and without string shoving), I will address that using the well known 2- and multi-particle cumulants we can answer the unknown initial versus final stage effects in small collision systems.

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