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Higher order asymmetries with exact hydrodynamics

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The time evolution of the medium created in heavy ion collisions can be described by hydrodynamical models. After expansion and cooling, the hadrons are created in a freeze-out. Their distribution describes the final state of this medium. Exact hydrodynamics provides a tool to have an analytic handle on the connection between the initial state, the dynamic parameters of the system and the observables. Usually azimuthal or elliptical symmetry is assumed in the transverse plane, as these are simple to handle and represent geometries to yield realistic observables like spectra, Bose-Einstein correlation functions and elliptic flow. However, nuclei contain a finite number of nucleons, are thus (on an event-by-event basis) not spherically symmetric. This results in an event-by-event fluctuating initial condition, which gives rise to higher order flow coefficients, with respect to higher order reaction planes. Correlation radii can also be measured with respect to higher order reaction planes, their comparison to higher order flow coefficients gives insight into the dynamics of the system. In this work we show the first exact analytic solutions of relativistic hydrodynamics [Ref1,Ref2] that assume higher order asymmetries (see Fig. [1]) and thus give realistic higher order flow coefficients (see Fig. [2]). Besides presenting the first such model, we also show a comparison of our results to various measured hadronic observables.

Ref1: M. Csanád, talk at the IX Workshop on Particle Correlations and Femtoscopy (presented by T. Csörgő)
https://indico.cern.ch/event/248321/session/12/contribution/33/material/slides/
Ref2: A. Szabó, talk at the 2013 Zimányi School
https://indico.cern.ch/event/286124/session/3/contribution/11/material/slides/

Fig 1.: http://csanad.web.elte.hu/phys/v3sol/vnplot3.png
Fig 2.: http://csanad.web.elte.hu/phys/v3sol/phenix3040.png

On behalf of collaboration:

None

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