Contribution ID: **123** Type: **Poster**

Directed Flow in event-by-event hydrodynamics

Fluctuations in the initial geometry of a nucleus-nucleus collision have been recently shown to produce the correlation structures known as ridge" andshoulder". These event-by-event fluctuations result in new types of anisotropic flow, such as triangular flow v_3 and a new type of directed flow v_1, which, unlike the usual directed flow, is also present at midrapidity. The anisotropic flows due to the fluctuations in the initial density profile result in different reference angles Ψ_n for every harmonic n, which are not necessarily correlated with the event plane angle Ψ_2 (the elliptic flow reference angle), used by the experimentalists to measure the anisotropic flows, as v_1, v_2 and v_4. Unlike triangular flow, this new v_1 has not been studied in a hydrodynamic framework.

This work is based on the first quantitative predictions for this new v_1 in Au-Au collisions at the top RHIC energy, using the hydrodynamic code NEXSPheRIO. NEXSPheRIO solves the relativistic ideal hydrodynamics using initial conditions provided by the event generator NeXus, providing good description for several observables, like elliptic flow. Shear viscosity is not implemented in this computation, though its effect should be smaller than higher harmonics, for instance v_2.

First, we compute this new v_1 versus transverse momentum and centrality for Au-Au collisions at RHIC using the hydrodynamic code NeXSPheRIO. Even without dedicated analysis of this new v_1, indirect evidence has been obtained from recent STAR correlation data, and we compared our results with those inferred data, finding remarkable agreement.

As the fluctuations in the initial geometry break the symmetry of the initial density profile, there will be one direction where the profile is steepest. This effect can be quantified by the magnitude dipole asymmetry ε_1, and by the steepest direction for a smooth profile Φ_1. For smooth initial conditions, one expects $\Psi_1 = \Phi_1$ and $v_1 \propto \varepsilon_1$ in each event. We compute those features for our bumpy initial conditions and compare with the directed flow quantities. We find that the event plane of v_1 is correlated with the angle of the initial dipole of the distribution, as predicted, though with a large dispersion, but it is uncorrelated with the reaction plane. This shows that the dipole asymmetry is indeed the mechanism to create v_1.

Reference: arXiv:1103.4605

Primary author: Dr GARDIM, Fernando (USP)

Co-authors: Prof. GRASSI, Frederique (USP); Prof. OLLITRAULT, Jean-Yves (Saclay); Dr LUZUM, Matthew (Saclay); Prof. HAMA, Yogiro (USP)

Presenter: Dr GARDIM, Fernando (USP)

Track Classification: Global and collective dynamics