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System size dependence of flow observables in hydrodynamic simulations

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Valuable information about the behavior of a heavy-ion collision system can be obtained by changing the species of colliding nuclei, and in particular using species of different size. This change in system size can probe characteristic behavior in a way that is not possible with a single collision system. Already, results of small collisions systems such as p-p, p-A, d-A, and ^{3}He have received much attention. Recently, the LHC performed ^{129}Xe-^{129}Xe collisions, a system with a size that is intermediate between small systems like p-p and large systems like Pb-Pb, at almost the same collision energy.

We perform hydrodynamic simulations of Xe-Xe and Pb-Pb collisions and argue that hydrodynamic behavior dictates definite relations between the results, regardless of the details of the simulations, due to scaling laws inherent to fluid dynamics. This can be used to test the hydrodynamic framework in general and search for a breakdown of hydrodynamics with decreasing system size.

Conversely, one can extract detailed information about system properties by studying carefully-selected observables. For example, the relative elliptic flow of the two systems in very central collisions is sensitive to the expected prolate deformation of the Xenon nucleus. Additionally, we describe a procedure to determine the average viscosity in a model-independent way by comparing selected ratios of flow coefficients in the two systems.

References: arXiv:1711.08499 and work in progress

Content type

Theory

Collaboration

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Authors: LUZUM, Matthew; Prof. NORONHA-HOSTLER, Jacquelyn (Rutgers University); Dr OLLITRAULT, Jean-Yves (Université Paris-Saclay); GIACALONE, Giuliano (Université Paris-Saclay)

Presenter: LUZUM, Matthew

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