Beam-energy and collision-system dependence of flow correlations and fluctuations in heavy-ion collisions

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Investigations of flow correlations and fluctuations in heavy-ion collisions can give in-depth insights into the expansion dynamics of these collisions. They can also provide new constraints for initial-state models to allow robust extraction of the specific shear viscosity η/s. The recent STAR differential measurements of the flow correlations (symmetric cumulants) and the flow-momentum correlations, $\rho(v_n^2, \langle p_T \rangle)$ [1], will be presented for several collisions-systems at different beam energies. The results show characteristic system- and beam-energy-dependent trends which are compared with similar LHC measurements [2,3] as well as calculations from several viscous hydrodynamic models. The comparisons between data and theoretical calculations show that the measurements can be used to pin down the respective influence of initial-state fluctuations, system-size, shape (ε), and $\eta/s(T)$. The implications of the constraining power of these measurements will be discussed.

[1] Piotr Bozek, Transverse momentum-flow correlations in relativistic heavy-ion collisions, Phys. Rev. C **93**, 044908 (2016).

[2] ATLAS Collaboration, Measurement of flow harmonics correlations with mean transverse momentum in lead-lead and proton-lead collisions at $\sqrt{s_{NN}} = 5.02$ TeV with the ATLAS detector, Eur. Phys. J. C **79**, 985 (2019).

[3] ALICE Collaboration, Investigations of Anisotropic Flow Using Multiparticle Azimuthal Correlations in pp, pPb, Xe-Xe, and Pb-Pb Collisions at the LHC, Phys. Rev. Lett **123**, 142301 (2019).