Do Anisotropy Scaling Functions constrain the initial-state eccentricity spectrum, deformation of atomic nuclei, and the final-state specific shear viscosity?

Roy Lacey

For the STAR Collaboration

Abstract

There is substantial current interest in developing solid constraints on the initial-state eccentricity and the final-state viscous attenuation in heavy-ion collisions at RHIC and LHC energies. Such constraints are essential for the precision extraction of the temperature (T) and baryon chemical potential (μ_B) dependence of the quark-gluon plasma's transport coefficients and studies of the deformed shape of atomic nuclei. Recently, we developed Anisotropy Scaling Functions (ASF) for v_n that leverage the combined response to initial-state eccentricity and final-state viscous attenuation [1,2] to set new and unique constraints. We will present and discuss a comprehensive set of ASFs for a broad range of p_T and centrality selections for systems selected from U+U, Pb+Pb, Au+Au, Cu+Au, Xe+Xe, Ru+Ru, Zr+Zr, Cu+Cu, O+O, ^{3}He+Au, d+Au and p+Au collisions spanning the RHIC-LHC beam energy range, and show that they constrain the eccentricity spectrum for the systems studied, shape deformations in U+U, Xe+Xe, Ru+Ru, and Zr+Zr, and the beam energy (or T) dependence of the specific shear viscosity of the plasma.

[1] STAR collaboration, Phys.Rev.Lett. 122 (2019) 17, 172301

[2] Peifeng Liu and Roy A. Lacey, Phys.Rev.C 98 (2018) 2, 021902