

The QGP shear viscosity: elusive goal or just around the corner?

Monday, May 23, 2011 5:30 PM (20 minutes)

The last two years have seen tremendous progress in the theoretical tools for extracting the specific shear viscosity of the quark-gluon plasma in the temperature range explored by heavy-ion collisions at RHIC and LHC. The effects of viscosity on the transverse momentum spectra and differential elliptic flow and their interplay with other hydrodynamic parameters have been studied systematically [1]. A global viscous hydrodynamic fit to charged and identified hadron spectra and elliptic flow at all collision centralities in RHIC Au+Au collisions has been shown to successfully extrapolate to Pb+Pb collisions at the LHC [2], providing a rather good first description of the elliptic flow measured by the ALICE collaboration. Viscous relativistic hydrodynamics has been coupled to a microscopic description of the late hadronic rescattering and freeze-out stage [3,4], thus eliminating previous large uncertainties arising from strong dissipative effects in the hadronic phase [5] and allowing for a first tightly constrained extraction of the QGP shear viscosity from RHIC data [3,6]. The largest remaining uncertainty arises from poor theoretical control over the initial spatial eccentricity of the collision fireball, and a lack of prospects to more tightly constrain this initial deformation theoretically appears to make progress towards further increased empirical precision for the QGP shear viscosity elusive. Recent studies of higher harmonic eccentricity and flow coefficients [7] and their fluctuations from collision to collision using event-by-event hydrodynamics provide, however, a novel angle that may allow to settle this question experimentally. This will be the main focus of my talk.

[1] Chun Shen, U. Heinz, P. Huovinen, H. Song, Phys. Rev. C82, 054904 (2010).

[2] Chun Shen, U. Heinz, et al., "Radial and elliptic flow in Pb+Pb collisions at the Large Hadron Collider from viscous hydrodynamics," to be published.

[3] H. Song, S. A. Bass, U. Heinz, T. Hirano and Chun Shen, arXiv:1011.2783.

[4] H. Song, S. Bass and U. Heinz, Phys. Rev. C, in press [arXiv:1012.0555].

[5] Chun Shen and U. Heinz, arXiv:1101.3703

[6] H. Song, S. Bass, U. Heinz, T. Hirano and Chun Shen, arXiv:1101.4638 [nucl-th].

[7] Zhi Qiu and U. Heinz, "Event-by-event shape and flow fluctuations in RHIC fireballs," to be published.

Primary author: HEINZ, Ulrich (The Ohio State University)

Presenters: SHEN, Chun (Ohio State University); HEINZ, Ulrich (The Ohio State University)

Session Classification: Global and collective dynamics

Track Classification: Global and collective dynamics