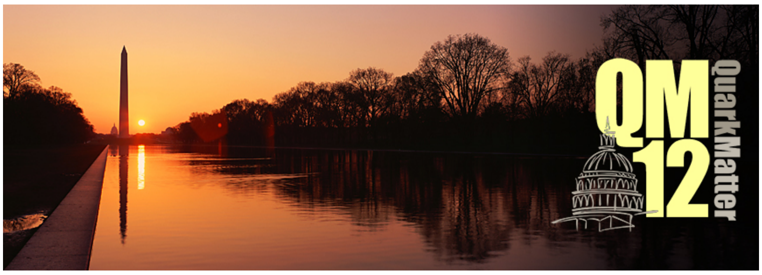

Contribution ID: **388**

Type: **Poster**

Dissipative Hydrodynamic Evolution of the QGP at Finite Baryon Density

Thursday, August 16, 2012 4:00 PM (2 hours)

The first results of the heavy ion program at LHC [1] suggest that the near-perfect fluidity discovered at RHIC is a universal property of the quark-gluon plasma (QGP) above and around the crossover temperature. The recent developments in hydrodynamic studies take account of the effects of shear and bulk viscosities as well as fluctuations for the quantitative understanding of the hot medium. On the other hand, net baryon number is neglected in most of the modern hydrodynamic analyses even though it is fully conserved at forward rapidity. Since the net baryon carries valuable information on the remnant of the colliding nuclei and thus on the magnitude of kinetic energy loss for the QGP production in the yet-unknown early thermalization stage, the next task for hydrodynamic analyses should be to incorporate finite baryon density.

In this study, I develop a novel dissipative hydrodynamic model with finite net baryon density to investigate the net baryon rapidity distributions at RHIC and LHC [2]. Baryon dissipation is taken into account together with shear and bulk viscosities by a generalized second order theory [3]. The state-of-art lattice QCD equation of state and the color glass type initial conditions are employed. The results show that the net baryon is carried to forward rapidity during the hydrodynamic evolution, which implies that the experimentally observed transparency of the collision at RHIC [4] is effectively enhanced. This indicates that the kinetic energy loss for the production of the hot medium at the initial stage is larger, and then a part of the energy is transferred back to the net baryon components through the strong medium interaction. Furthermore, the net baryon distribution is found sensitive to baryon diffusion as well as to viscosities. This opens a possibility of constraining all the transport coefficients experimentally, including the ones at finite density such as baryon diffusion coefficient and thermo-diffusion cross coefficient. The results indicate that the dissipative hydrodynamic modeling would be important for extracting unique properties of the hot medium even in the high-energy collisions.

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Session Classification: Poster Session Reception

Track Classification: Global and collective dynamics