Contribution ID: **31** Type: **not specified**

Transport Coefficients of the Quark-Gluon Plasma: From Weak to Strong Coupling

Friday, May 11, 2012 5:00 PM (30 minutes)

The knowledge of transport coefficients of the Quark-Gluon Plasma (QGP) gives fundamental insights into the nature of strongly interacting matter under extreme conditions. By means of relativistic heavy-ion collisions, these properties are intended to be experimentally revealed, providing also information about the structure of the produced hot matter. One of the remarkable findings is that the QGP created in experiments at RHIC and LHC is an almost ideal fluid obeying, apart from ultra-cold fermionic systems near unitarity, the smallest shear viscosity to entropy density ratio observed in nature.

By means of a quasi-particle model for QCD thermodynamics, which is related to QCD via the two-loop phi-functional formalism, featuring dynamically generated self-energies of the excitation modes and being extended to non-equilibrium systems self-consistently within an effective kinetic theory approach, the temperature dependence of shear and bulk viscosity coefficients of the QGP is investigated [1]. Showing the parametric dependencies on coupling and temperature known from perturbative QCD at large temperatures, their extrapolation into the non-perturbative regime near the deconfinement transition temperature exhibits fairly nice agreement with available lattice QCD results for the pure gluon plasma. Moreover, the ratio of bulk to shear viscosity depicts at large temperatures the quadratic dependence on the conformality measure known from perturbative QCD, while in the vicinity of the deconfinement transition a linear behaviour as known from specific strongly coupled theories based on the gauge/string duality is found [2]. Via weak coupling arguments, an interrelation between the specific shear viscosity and the energy loss parameter can be derived [3]. The transport coefficient determined in this way exhibits a pronounced temperature dependence, which serves as a possible explanation for the observed centrality dependence of the azimuthal anisotropic flow.

[1] M. Bluhm, B. Kampfer, K. Redlich, Phys. Rev. C 84 (2011) 025201

[2] M. Bluhm, B. Kampfer, K. Redlich, Phys. Lett. B 709 (2012) 77

[3] A. Majumder, B. Muller, X.-N. Wang, Phys. Rev. Lett. 99 (2007) 192301

Author: Dr BLUHM, Marcus (Laboratoire SUBATECH)

Co-authors: Prof. KAMPFER, Burkhard (Helmholtzzentrum Dresden-Rossendorf); Prof. REDLICH, Krzysztof (University of Wroclaw); Dr NAHRGANG, Marlene (Laboratoire SUBATECH)

Presenter: Dr BLUHM, Marcus (Laboratoire SUBATECH)