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QGP viscosity coefficients: from weak to strong coupling

By means of high energy nuclear collisions, the properties, such as the viscosity coefficients, of QCD matter under extreme conditions are intended to be experimentally revealed. One remarkable result from collisions at RHIC is that the produced hot matter is an almost ideal fluid, obeying the smallest shear viscosity to entropy density ratio observed in nature. Employing an effective kinetic theory for quasiparticle excitations featuring dynamically generated self-energies, we determine the temperature dependence of the viscosity coefficients of deconfined strongly interacting matter [1,2]. This knowledge may serve as input for the phenomenological description of heavy-ion collisions at LHC and RHIC.

Exhibiting the parametric dependencies known from perturbative QCD at large temperatures, the extrapolation of our results into the non-perturbative region shows fairly nice quantitative agreement with lattice QCD results in the case of a pure gluon plasma. We find a minimum in the specific shear viscosity and a rapid increase of the specific bulk viscosity near the deconfinement transition temperature T_c. The ratio of bulk to shear viscosity comprises both, a quadratic dependence on the conformality measure at large temperatures as known from pQCD as well as a linear dependence near T_c as known from specific strongly coupled and nearly conformal theories based on gauge/string duality [3]. Thus, the exploited framework provides a systematic interpolation between both regimes of weak and strong coupling.

[1] M. Bluhm, B. Kampfer, K. Redlich, Nucl. Phys. A 830 (2009) 737C
[2] M. Bluhm, B. Kampfer, K. Redlich, arXiv:1011.5634
[3] M. Bluhm, B. Kampfer, K. Redlich, arXiv:1101.3072

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