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Transport properties of the hot and dense QGP

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We study the influence of the baryon chemical potential μ_B on the dynamical properties of the Quark–Gluon–Plasma (QGP) in and out-of equilibrium. The description of the QGP in equilibrium is based on the effective propagators and couplings from the Dynamical QuasiParticle Model (DQPM)that is matched to reproduce the equation-of-state of the partonic system above the deconfinement
temperature Tc from lattice Quantum Chromodynamics (QCD).
We study the transport coefficients such as the ratio of the shear and bulk viscosities to the entropy density, i.e. η/s and ζ/s, the electric conductivity σ_0/T as well as the baryon diffusion coefficient κ_B and compare to related approaches from the literature(non-conformal holographic model, lattice QCD, NJL). We find that the ratios η/s and ζ/s as well as σ_0/T are in accord with the results from lattice QCD at μ_B=0. Furthermore, we have considered the shear viscosity and the electric conductivity of strongly interacting quark matter within the extended Nf= 3 Polyakov Nambu-Jona-Lasinio (PNJL) model along with the crossover transition line for moderate values of baryon chemical potential 0≤μ_B≤0.9 GeV as well as in the vicinity of the critical end point (CEP) and at large baryon chemical potential $\mu_B = 1.2$ GeV, where the first-order phase transition takes place.

We explore how the nature of the degrees-of-freedom affects the transport properties of the QGP. Moreover, we study the possible influence of the presence of a CEP and of a 1st order phase transition at high baryon chemical potential.
The out-of equilibrium study of the QGP is performed within the Parton–Hadron–String Dynamics (PHSD) transport approach extended in the partonic sector by explicitly calculating the total and differential partonic scattering cross sections based on the DQPM and the evaluated at actual temperature T and baryon chemical potential μ_B in each individual space-time cell where partonic scattering takes place. The traces of their μ_B dependencies are investigated in different observables for symmetric Au + Au and asymmetric Cu + Au collisions such as rapidity and m_T-distributions and directed and elliptic flow coefficients v1, v2 in the energy range (s_NN)^(1/2) from 7.7 GeV to 200 GeV.

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