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Heat- and Electric Conductivity of the Quark-Gluon Plasma

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The study of transport coefficients of the Quark-Gluon Plasma (QGP) provides useful comparisons amongst different theories and models, and gives physical insights into the microscopic details of the QGP.

We work with the partonic transport model BAMPS (Z. Xu and C. Greiner, Phys. Rev. C, pp. 1–121, 2005.), solving the relativistic Boltzmann equation for several species of charged partons. BAMPS has implemented elastic and inelastic pQCD scattering routines (O. Fochler, J. Uphoff, Z. Xu, and C. Greiner, Phys. Rev. D, pp. 1–11, 2013.) and allows for a systematic study of the influence of scattering on the transport coefficients. In this study, only static box-simulations of hot quark matter are performed.

Via Green-Kubo relations transport coefficients like the electric conductivity or heat conductivity can be explored.
Furthermore, we employ the classical picture, evaluating the static diffusion current upon influence of an external electric field. For the heat conductivity, a temperature gradient can be build up and the resulting static heat flow measured (M. Greif, F. Reining, I. Bouras, G. Denicol, Z. Xu, and C. Greiner, Phys. Rev. E, vol. 87, no. 3, p. 033019, Mar. 2013.). We show the equivalence of the Green-Kubo method and the the "textbook-picture"-methods. We give results for these transport coefficients for simple toymodel systems and the more realistic case of a fully inelastically interacting QGP.

The electric conductivity of the QGP has been calculated by different lattice groups, Dyson-Schwinger calculations and transport simulations. We compare our results with others. We present different analytical approaches to solve the Boltzmann equation, aiming for transport coefficients of the QGP, and compare them to our numerical results.

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