Quantum simulationS of thermodynamic and transport properties of quark – gluon PLASMA

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For quantum simulations of the thermodynamic and transport properties of the quark–gluon plasma (QGP) within a unified approach, we combine path integral and Wigner (phase space) formulations of quantum mechanics [1, 2]. The thermodynamic properties of a strongly coupled quark-gluon plasma (QGP) of the constituent quasiparticles are studied by color path-integral Monte-Carlo simulations (CPIMC). For simulations we have presented the QGP partition function in the form of a color path integral with a new relativistic measure, instead of a Gaussian one used in Feynman and Wiener path integrals. For integration over the color variable we have also developed procedure of sampling the color variables according to the group SU(3) Haar measure. It is shown that this method is able to reproduce the available quantum lattice chromodynamics (QCD) data.

The canonically averaged quantum operator time correlation functions and related kinetic coefficients are calculated according to the Kubo formulas. In this approach CPIMC is used not only for calculation thermodynamic functions but also to generate initial conditions (equilibrium spatial, momentum, spin, flavor and color quasiparticle configurations) for generating the color phase space trajectories being the solutions of the related dynamic differential equations. Correlation functions and kinetic coefficients are calculated as averages of Weyl's symbols of dynamic operators along these trajectories. Using this approach we have calculated the diffusion coefficient and shear viscosity, which agree well with experimental data obtained at RIHC.

References

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**Список авторов**

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