Color path-integral Monte-Carlo simulations of strongly coupled quark-gluon plasma
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Abstract
The most fundamental way to compute properties of the strongly coupled quark-gluon plasma (QGP) is provided by the lattice QCD. Interpretation of these complicated computations requires application of various QCD motivated models simulating various aspects of the full theory. More over these models are needed in cases when the lattice QCD fails, e.g. at large baryon chemical potentials and out of equilibrium. A quasiparticle model has been recently introduced in literature. It is expected that it allows to treat soft processes in the QGP which are not accessible by the perturbative means and the main features of non-Abelian plasmas can be understood without the difficulties inherent to quantum field theory.

For quasiparticle QGP model we propose stochastic simulation of thermodynamics and kinetic properties in the wide region of temperature, density and quasiparticles masses. We extend previous classical simulations based on a color Coulomb interaction to the relativistic quantum regime. In grand canonical ensemble for finite and zero baryon chemical potential we use the direct quantum path integral Monte Carlo method (PIMC) within Feynman formulation of quantum mechanics. For the strongly correlated QGP we have done calculations of equation of state, spatial and color pair distribution functions, diffusion coefficients and shear viscosity.