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Critical point search from an extended parameter space of lattice QCD at finite temperature and density

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Aiming to understand the phase structure of lattice QCD at nonzero temperature and density, we study the phase transitions of QCD in an extended parameter space, where the number of flavor, quark masses, complex chemical potentials and so on are considered as parameters.
Performing simulations of 2-flavor QCD with improved staggered and Wilson fermions and using the reweighting method, we calculate probability distribution functions in various systems.
An interesting system is (2+Nf)-flavor QCD at finite density, where two light flavors and Nf massive flavors exist.
For large Nf, we can easily investigate the critical surface terminating first order phase transitions in the parameter space of the light quark mass, the heavy quark mass and the chemical potential.
We determine the critical surface by looking at the shape of distribution functions.
Another interesting system is QCD with a complex chemical potential.
We investigate the singularities where the partition function vanishes, so-called Lee-Yang zeros, and possible Stokes lines.
Through the studies of these systems, we discuss the phase structure of QCD at finite density.

On behalf of collaboration:

[Other]

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