

Can the complex Langevin method see the deconfinement phase transition in QCD at finite density?

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Exploring the phase diagram of QCD at finite density is a challenging problem since first-principle calculations based on standard Monte Carlo methods suffer from the sign problem. As a promising approach to this issue, the complex Langevin method (CLM) has been pursued intensively.

In this talk, we investigate the applicability of the CLM in the vicinity of the deconfinement phase transition using the four-flavor staggered fermions. A previous study on a $16^3 \times 8$ lattice showed that the CLM fails at $\beta < 5.15$ due to the excursion problem, which made the transition to the confined phase inaccessible. In this study, we employ a lattice with larger temporal size in order to make the CLM work at lower temperature. In particular, we investigate the β -dependence of the chiral condensate to look for a hysteresis which signals the expected first order phase transition.

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