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Properties of net−baryon number cumulant ratios in the strong coupling limit of lattice QCD at finite density

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Critical phenomena in quantum chromodynamics (QCD) have been attracting attention to find features of chiral symmetry breaking (or restoration) in QCD. QCD critical point (CP) is one of the cornerstones to deduce the QCD phase structure. Theoretically, higher than 3rd order cumulants can be negative [1] due to Z(2) criticality around CP [2] and the remnant effect of O(4) criticality in the crossover region [3] at finite mass and nonzero chemical potential. These sign flips are useful tools to investigate the phase transition, so we need explicit calculations to see actual critical behaviors beyond universality arguments.
The strong coupling approach of lattice QCD provides an efficient method to investigate the QCD phase diagram by virtue of a milder sign problem. We have recently investigated higher-order cumulant ratios of the net-baryon number in the strong coupling and chiral limits with fluctuations of auxiliary fields [4]. We find that the finite volume effect smears the divergence of cumulant ratios and gives rise to the negative kurtosis region [4] while it positively diverges in the chiral and thermodynamic limits [3]. In the presentation, we will give results of the cumulant ratios and discuss the relations to the scaling function analysis discussed in [3]. We will also discuss finite size scaling analyses.

References

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