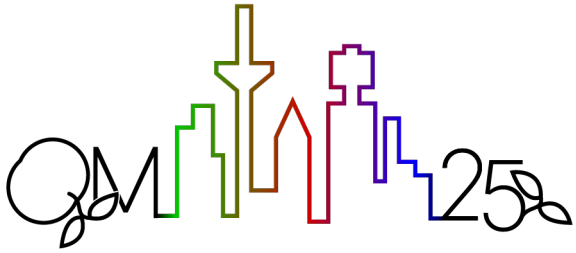

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Thermodynamic geometry of the QCD phase transition

We explore the thermodynamic geometry in the context of the chiral phase transition of Quantum Chromodynamics. In particular the thermodynamic curvature, R, provides insights into the system's fluctuations and critical behavior and thus can be considered as an alternative way to approach the study of critical phenomena. Building upon previous studies, we incorporate bosonic fluctuations through the functional renormalization group (FRG) technique, a non-perturbative approach suitable for investigating critical phenomena, reformulating the flow equation into an advection-diffusion type equation within the local potential approximation for the effective average action.

We study how the sign of R changes near the chiral crossover and the critical point, providing insights into the underlying dynamics of the phase transition. The results indicate that R exhibits a peak close to the chiral crossover and that the inclusion of fluctuations generally lowers the magnitude peak these peaks. At low chemical potential, R remains negative, showing that the inclusion of bosonic fluctuations prevents the system from overcoming the fermionic repulsion among quarks. We further explore the low-Chemical potential regime by artificially lowering the pion mass, approaching the chiral limit where the crossover transitions to a second-order phase change.

As the baryion Chemical potential increases towards the critical point, R develops shaprer peaks and undergoes a sign change, consistent with findings from mean-field theory. Thus, our analysis supports the idea that the thermodynamic curvature R is sensitive to the chiral crossovers and chiral phase transition, providing valuable insights into the system's behavior near criticality.

Category

Theory

Collaboration (if applicable)

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