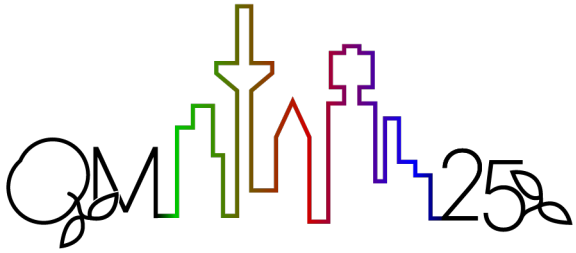

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Searching for the QCD Critical Endpoint from Lattice QCD Simulations at a Low Temperature

Significant efforts have been made within the heavy-ion collision community to locate the QCD critical endpoint (CEP). Recent lattice QCD studies using imaginary chemical potentials, based on simulations at temperatures above 120 MeV and utilizing Lee-Yang edge singularities in the complex chemical potential plane, suggest that the critical temperature at the CEP, T_c^{CEP}, should be around 110 MeV \[1\]. Predictions from effective theories, such as AdS/CFT \[2\], the Functional Renormalization Group (FRG) \[3\], and Dyson-Schwinger Equations (DSE) \[4\], align with this lattice result.

In our study, we conduct direct lattice QCD simulations with imaginary chemical potential at a low temperature of 107 MeV, using Highly Improved Staggered Quarks (HISQ) at the physical pion mass on $N_t = 10$ lattices. We obtain up to 4th order baryon number fluctuations for each of the 24 values of imaginary baryon chemical potentials ranging from zero to $i\pi$. This enables us to apply multi-point Padé approximants and compute Fourier coefficients of the baryon number density in the complex chemical potential plane. Through these analyses, we examine indications of CEP through the prospective Lee-Yang edge singularities in the complex chemical potential plane at this low temperature.

1 David A. Clarke, et al., arXiv: 2405.10196

2 Mauricio Hippert et al., Phys.Rev.D 110 (2024) 9, 094006

3 Wei-jie Fu, Jan M. Pawlowski, and Fabian Rennecke, Phys. Rev. D 101 (2020) 5, 054032

4 Pascal J. Gunkel and Christian S. Fischer, Phys. Rev. D 104 (2021) 5, 054022

Category

Theory

Collaboration (if applicable)

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