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Bayesian Inference of the Critical Endpoint and heavy quarkonium potential energy in flavor-dependent systems from Holographiy QCD

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By incorporating the equation of state and baryon number susceptibility from lattice QCD with error bars at zero chemical potential, we developed a Bayesian Inference model within the framework of holographic QCD. This model includes error estimates derived from lattice data. Based on this Bayesian holographic model, we investigated the thermodynamic quantities for the 2-flavor and 2+1-flavor systems. Using Bayesian analysis, we calibrated the parameters and then calculated the critical endpoint (CEP) location for the best-fit results of the 2-flavor and 2+1-flavor systems as ($\mu_B = 0.430$ GeV, $T = 0.110$ GeV) and ($\mu_B = 0.702$ GeV, $T = 0.091$ GeV), respectively. We also computed the CEP regions within the 68\% and 95\% confidence intervals in the posterior distribution for both cases. We compared our findings with the possible CEP locations proposed by other theoretical models to verify the validity of our model. Additionally, we employed this model to study the potential energy of heavy quarkonium for the 2-flavor and 2+1-flavor systems using Bayesian analysis, presenting posterior distribution results for the heavy quark potential energy.

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