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The 221th HENPIC seminar by Song He (何松), Ningbo University, Jan. 09-2025, Thursday 10:30 am (Beijing time)

Title: Mapping QCD Phase Diagram via Data-based Holographic model

Abstract:
In this report, we propose a unified data-based holographic QCD model. This model quantitatively describes the equations of state (EoS) for 2+1-flavor QCD, 2-flavor QCD, and the SU(3) pure gluon system, utilizing lattice QCD data and existing data on the QCD EoS from the STAR collaboration. The model provides a self-consistent framework for describing the equations of state of QCD matter, and verifies the consistency of QCD properties such as quark condensation and gluon condensation. Using this model, we predict the QCD phase diagram at finite density and temperature, and the critical behavior of the critical end point (CEP). Finally, we employ machine learning algorithms based on this model to reproduce the magnetized equations of state for the 2+1-flavor QCD system and quantitatively predict the magnetic QCD phase diagram, along with the critical behavior of its CEP.

Brief introduction about the speaker:
Song He is a professor at the Institute of Fundamental Physics and Quantum Science, Ningbo University. His research spans gravitational theory, quantum field theory, string theory, and mathematical physics. He earned his Ph.D. from the Institute of High Energy Physics, Chinese Academy of Sciences, in 2011. He then conducted postdoctoral research at the Institute of Theoretical Physics, Chinese Academy of Sciences, the Yukawa Institute for Theoretical Physics at Kyoto University, and the Max Planck Institute for Gravitational Physics in Germany. In 2019, he joined Jilin University as a professor, where he remained until 2024.
His current research explores gravity through dualities in string theory and quantum field theory, with a focus on combining quantum information theory and duality methods to study fundamental gravitational properties. He also applies gauge/gravity duality to non-perturbative problems in quantum field theory, particularly in quantum chromodynamics (QCD) and strongly correlated condensed matter systems.

Summary

Presenter: Prof. HE, Song