Contribution ID: **129** Type: **口头报告**

Nuclear equation of state at finite μ_B using deep learning assisted quasi-parton model}

Saturday, 26 April 2025 11:15 (20 minutes)

Accurately determining the nuclear equation of state (EoS) at finite baryon chemical potential (μ_B) is crucial yet challenging in studying QCD matter under extreme conditions. This study develops a deep learning-assisted quasi-parton model using three deep neural networks. It reconstructs the QCD EoS at zero μ_B and predicts the EoS and transport coefficient η/s at finite μ_B. The model-derived EoS aligns well with lattice QCD results from Taylor expansion techniques. The minimum η/s is about 175 MeV and decreases with increasing chemical potential within the confidence interval. This model offers a robust framework for understanding the QCD EoS at finite μ_B and provides essential input for relativistic hydrodynamic simulations of nuclear matter in heavy-ion collisions by the RHIC beam energy scan program.

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Session Classification: 分会场一