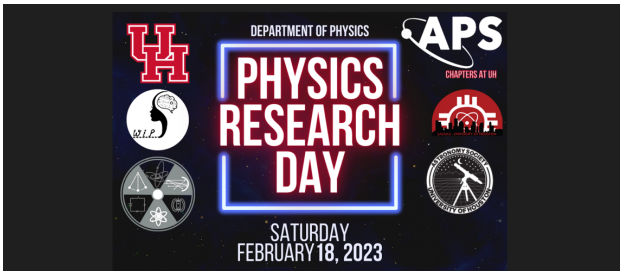

Contribution ID: **17** Type: **Talk**

QCD equation of state at finite density with a critical point from an alternative expansion scheme

Saturday 18 February 2023 13:30 (15 minutes)

In Ref. [1], results for the QCD equation of state from the lattice Taylor expansion were combined with the 3D Ising model critical behavior, to build a family of equations of state which match first principle results and contain a critical point in the expected universality class for QCD. This family of equations of state was limited to chemical potentials $0 \leq \mu_B \leq$450 MeV, due to the limitations of the Taylor expansion. In Ref.[2], an alternative expansion scheme was introduced, for extrapolating the lattice QCD equation of state to finite chemical potential. In this research, we combine these two approaches to obtain a family of equations of state in the range $0 \leq \mu_B \leq 700$ MeV and $30MeV \leq T \leq 800$ MeV, that match the lattice QCD results at small density and contain a 3D-Ising model critical point. With these new equations of state, we substantially extend the coverage of the QCD phase diagram.
Our open-source code allows the user to choose the position and strength of the critical point. Our results provide an input for hydrodynamical simulations at finite T and unprecedentedly large μ_B and will help constrain the location of the critical point through a comparison with experimental data from the Second Beam Energy Scan at RHIC.

[1] Parotto, P., Bluhm, M., Mroczek, D., Nahrgang, M., Noronha-Hostler, J., Rajagopal, K., ... & Stephanov, M. (2020). QCD equation of state matched to lattice data and exhibiting a critical point singularity. Physical Review C, 101(3), 034901.

[2] Borsányi, S., Fodor, Z., Guenther, J. N., Kara, R., Katz, S. D., Parotto, P., ... & Szabó, K. K. (2021). Lattice QCD equation of state at finite chemical potential from an alternative expansion scheme. Physical review letters, 126(23), 232001.

Academic year

3rd year

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Session Classification: Parallel Session 1

Track Classification: High Energy Physics, Nuclear Theory and QFT