Contribution ID: **42** Type: **Poster**

QCD EoS in non-zero baryon density and strong magnetic field

Equilibrium properties of strongly interacting matter are typically characterized by the quantum chromodynamics (QCD) equation of state (EoS). External factors, especially magnetic fields, can significantly influence this characterization. In efforts to delve deeper into these properties, we perform lattice simulations of $(2+1)$-flavor QCD using improved staggered quarks at the physical pion mass on $32^3 \times 8$ and $48^3 \times 12$ lattices. We explore the QCD EoS at non-zero baryon density and in strong magnetic fields, with magnitudes up to 0.8 GeV^2, using the Taylor expansion framework. We present leading order lattice QCD analysis, along with the hadron resonance gas framework comparison, for the coefficients of bulk thermodynamic quantities such as pressure, number density, energy density, and entropy density, discussing the significant impact of strong magnetic fields.

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