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Equation of state for QCD with a critical point from the 3D Ising Model

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Currently, one of the major investigations in heavy ion physics concerns the search for the QCD high temperature critical
point associated with the chiral transition, which has stimulated tremendous effort from both theory and experiment. On the theory side, a major role in the analysis of experimental results is played by hydrodynamical simulations of heavy ion collisions, which need as an input an equation of state driving the evolution of the system. Current knowledge of the finite-density QCD equation of state from first principles is limited to a Taylor expansion in the baryonic chemical potential around $\mu_B = 0$.

By means of a scaling form for the equation of state of the 3D Ising model and a non-universal, parametrized map to QCD coordinates, we construct an equation of state matching state of the art first principle Lattice QCD calculations and including the correct critical behavior, which can be readily employed in hydrodynamical simulations of heavy ion collisions at finite density, covering most of the BES range at RHIC.

The parametrized form of this equation of state can be exploited to constrain the value of the parameters themselves by imposing thermodynamic consistency and through comparison of predictions obtained by simulations with experimental results.

This contribution reports on work done within the Fluctuations/Equation of State working group of the BEST Collaboration.

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Primary author: PAROTTO, Paolo (University of Houston)

Co-authors: Dr BLUHM, Marcus (University of Wroclaw); MROCZEK, Debora (University of Houston); NAHRGANG, Marlene (Subatech); Prof. NORONHA-HOSTLER, Jacquelyn (Rutgers University); RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US)); RATTI, Claudia (University of Houston); STEPHANOV, Misha (UIC)

Presenter: PAROTTO, Paolo (University of Houston)

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