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Modeling Heavy-ion Collisions at Non-zero Chemical Potentials

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Realistic modeling of nucleus-nucleus collisions at finite baryon chemical potential is necessary to extract the location of the critical point on the QCD phase diagram and to understand the findings of the recently concluded Beam Energy Scan (BES) program at RHIC and the future planned experiments at FAIR and NICA. We propose a hydrodynamic model with three new elements. Firstly, we present a new initial state model at non-zero chemical potential based on the Monte-Carlo sampling of the nucleon-nucleon scattering extrapolated to nucleus-nucleus collisions (LEXUS [1]). This model dynamically initializes hydro, which is evolved using MUSIC [2]. Secondly, we employed a new cross-over equation of state [3]. Finally, we calculated the departure functions at finite chemical-potential using a quasi-particle theory of transport [4] and used it in Cooper-Frye procedure. We present comparisons with STAR data for a wide range of collision energies - 7.7 GeV - 200 GeV.

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