Nuclear modification factor of inclusive charged particles in Au+Au collisions at $\sqrt{s_{NN}}$ = 7.7-27 GeV with the STAR experiment and comparing with URQMD and SMASH+vHLLE model

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Abstract

The Quantum Chromodynamics (QCD) phase diagram, characterized by temperature (T) and baryon chemical potential (μ_B), features a transition from hadronic matter to a deconfined quark-gluon plasma (QGP). The Beam Energy Scan (BES) program at the Relativistic Heavy Ion Collider (RHIC) explores this phase structure by systematically varying the collision energy of Au+Au collisions, with a key focus on locating the QCD critical point.

During the first phase (BES-I, 2010–2014), the STAR experiment measured the nuclear modification factor (R_{CP}) for Au+Au collisions in energy range $\sqrt{s_{NN}}$ = 7.7–27 GeV. In 2018, the STAR experiment initiated the second phase of the BES-II program, which is have a tenfold increase in statistics compared to the first phase. This will enable a deeper understanding of the nuclear modification factor and improve its description. In 2021, STAR collected 500 million Au+Au events at $\sqrt{s_{NN}}$ = 7.7 GeV—two orders of magnitude larger than the BES-I dataset at this energy.

In this talk, we present new measurements of charged-particle production and R_{CP} from the high-statistics BES-II 7.7 GeV data, comparing them with BES-I results. We further evaluate theoretical descriptions using URQMD and hydrodynamic (HYDRO) model predictions, testing their consistency with experimental observations. By extending the analysis to higher transverse momenta (p_T), we probe potential jet quenching effects and assess implications for QGP formation and properties at lower collision energies.