Contribution ID: **220** Type: **Oral**

Electromagnetic tomography of Quark-Gluon Plasma at finite baryon densities

Relativistic heavy-ion collisions at the RHIC Beam Energy Scan program and SPS energies probe the QCD phase diagram at finite baryon densities. Precise photon and dilepton measurements serve as unique tomographic probes for the properties of hot nuclear matter. In this work, we study the electromagnetic radiation from relativistic heavy-ion collisions from 7.7 to 200 GeV. The dynamical evolution of the QCD medium is calibrated with hadronic data in the RHIC Beam energy scan program based on a recent (3+1)D Bayesian analysis [1, 2]. We convolute the full model posterior distribution from the Bayesian analysis to make robust predictions for the electromagnetic observables with the propagated theoretical uncertainties. We will show how photon and dilepton observables, especially their rapidity dependence, can impose complementary constraints on the QGP dynamics and help to deduce its transport properties at finite baryon densities.

[1] C. Shen, B. Schenke and W. Zhao, "Viscosities of the Baryon-Rich Quark-Gluon Plasma from Beam Energy Scan Data," Phys. Rev. Lett. 132, no.7, 072301 (2024)

[2] S. A. Jahan, H. Roch and C. Shen, "Bayesian analysis of (3+1)D relativistic nuclear dynamics with the RHIC beam energy scan data," arXiv:2408.00537 [nucl-th].

Category

Theory

Collaboration (if applicable)

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Track Classification: Electromagnetic probes