Contribution ID: **147** Type: **Oral**

Initial-state and final-state effects on hadron production in small collision systems

Wednesday 6 September 2023 12:20 (20 minutes)

Heavy meson production in reactions with nuclei is an active new frontier to understand QCD dynamics and the process of hadronization in nuclear matter. Measurements in various colliding systems at RHIC and LHC, including Pb-Pb, Xe-Xe, O-O, p-Pb, and p-O, enable precision tests of the medium-size, temperature, and mass dependencies of the in-medium parton propagation and shower formation. We employ a coupled DGLAP evolution framework that takes advantage of splitting functions recently obtained in soft-collinear effective theory with Glauber gluons ($\mathrm{SCET_G}$) and hard thermal loop (HTL) motivated collisional energy loss effects. With jet quenching effects constrained to the nuclear modification factor R_{AA} of charged hadrons in Pb-Pb collisions at 5.02˜TeV, we present predictions for light and heavy-meson R_{AA} in Xe-Xe, O-O and p-Pb collisions at the LHC. We find that the nuclear modification scales non-trivially with the quark mass and medium properties. In particular, there can be sizeable collision-induced attenuation of heavy mesons in small systems such as oxygen-oxygen and high-multiplicity p-Pb events. Finally, we analyze the impact of different models of initial-state parton dynamics on the search for QGP signatures in small colliding systems.

Category

Theory

Collaboration (if applicable)

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Session Classification: Small Systems

Track Classification: Small systems