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Medium-induced coherent gluon radiation and heavy flavor suppression in pA collisions

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High-energy proton-nucleus (pA) collisions have provided intriguing playgrounds for disentangling various cold nuclear matter effects on hadron production. Multiple rescatterings in the cold nuclear target induce many soft gluons that have a long formation time, resulting in the modification of hadron production rates due to fully coherent energy loss (FCEL). Medium-induced FCEL has proven to be crucial in explaining heavy meson (J/ψ , D) nuclear suppression in pA collisions in a wide range of collision energy [1,2].

Understanding the qualitative and quantitative role of the FCEL effect for the quenching of hadron production rates in a wide kinematic range is a crucial task, requiring rigorous calculations of the medium-induced soft gluon radiation spectrum. This talk will present new results for the induced single soft gluon radiation spectrum beyond leading logarithmic accuracy, enhancing the predictive power of FCEL estimations in the phenomenology of hadron production in pA collisions. The general formula is valid in the full kinematic range of the underlying processes, quantifying the entanglement between the color components of the production amplitude [3]. We will discuss the impact of the newly induced spectrum on heavy flavor suppression in pA collisions.

[1] F. Arleo, S. Peigne, Phys. Rev. Lett. 109 (2012) 122301

[2] F. Arleo, G. Jackson and S. Peigne, JHEP 01 (2022) 164

[3] G. Jackson, S. Peigne and K. Watanabe, JHEP 05 (2024) 207

Category

Theory

Collaboration

Primary authors: JACKSON, Greg (SUBATECH (CNRS/IN2P3)); WATANABE, Kazuhiro (Seikei University); PEIGNE, Stephane (CNRS (new))

Presenter: WATANABE, Kazuhiro (Seikei University)

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