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Unraveling Gluon Jet Quenching through J/ψ Production in Heavy-Ion Collisions

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Jet quenching has long been regarded as one of the most important signatures for the discovery of Quark-Gluon Plasma created in heavy-ion collisions. Despite significant efforts, separate identification of quark and gluon jet quenching has remained as a challenge. We illustrate for the first time that energetic J/ψ production can be served as a unique probe to the gluon jet quenching mechanism. Within the framework of leading power NRQCD factorization formalism for the baseline of proton-proton collisions, we identify that gluon fragmentation dominates the production of J/ψ in high transverse momentum region. We then implement the linear Boltzmann transport model for the simulation of medium modification, the obtained results of nuclear modification factor R_{AA} and elliptic flow v_2 agree with the experimental data, which demonstrates the significance of gluon jet quenching in J/ψ production in nucleus-nucleus collisions. We further verify such effect by performing a fully data-driven analysis of the experimental data with Bayesian technique, which allows us to extract quantitatively the gluon jet quenching in high energy heavy-ion collisions.

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