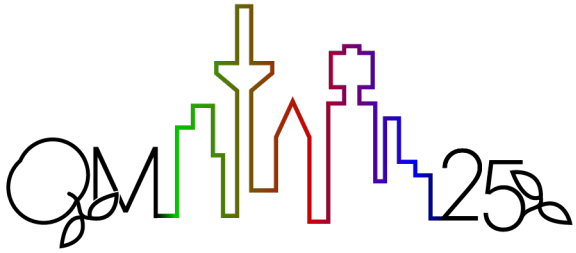

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Heavy Quark Energy Loss and Recombination within the Hybrid Model

To date, holographic calculations have provided separate descriptions for the rates of energy loss for either ultrarelativistic massless quarks and gluons or infinitely massive quarks in strongly coupled N=4 SYM plasma. We present a unified description of heavy quark energy loss by combining the limits of zero mass $M \to 0$ and infinite mass $M \to \infty$ in such a way that ensures continuity in both the energy $E(x)$ and its derivative $E'(x)$ with respect to the distance traveled. At early times, when the heavy quark is relativistic, our model aligns with the $M \to 0$ limit, while at late times, when the quark is being dragged by the medium, it approaches the $M \to \infty$ limit. We implement this unified description within the Hybrid Strong/Weak Coupling Model and incorporate a local color-neutralization mechanism occurring through the recombination of the heavy quark with a nearby opposite color charge (either a light antiquark or a diquark) from the surrounding flowing medium—a process that contributes significantly to the transverse momentum p_T at low p_T. By turning recombination off and on we isolate the effect of transverse flow on the R_{AA} and v_2 of B- and D-mesons; we compare these observables as well as the R_{AA} and v_2 of b- and c-jets to available experimental data. We also investigate the mass dependence of heavy quark energy loss. Furthermore, we explore jet substructure observables and angular distributions of heavy quarks within jets, offering new probes into heavy quark diffusion in the quark-gluon plasma.

Category

Theory

Collaboration (if applicable)

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