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Hard probe radiative energy loss beyond soft-gluon approximation

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One of the widely used kinematic assumptions in calculating hard probe radiative energy loss within QGP, is the soft-gluon approximation, which considers that energy loss of the parent parton via gluon's bremsstrahlung is small compared to its initial energy. However, diverse theoretical formalisams obtained a notable energy loss of high $p_\perp$ particles, implicitly suggesting inadequacy of this approximation.

To address this issue, we relaxed the soft-gluon approximation within DGLV formalism [1]. The obtained analytic expressions are quite more involved compared to the soft-gluon case. The effects of this relaxation on numerical predictions for the first order in opacity fractional radiative energy loss and number of radiated gluons are small, although of opposite signs. Moreover, a joint effect for these two variables results in an insignificant suppression alternation. Consequently, the results presented here provide confidence that, regardless of the concerns mentioned above, surprisingly, the soft-gluon approximation can reliably be applied within DGLV formalism. Finally, we discuss generalizing the relaxation in the dynamical medium as well, which ensures broader relevance of the conclusions obtained here.

[1] B. Blagojevic, M. Djordjevic and M. Djordjevic, arXiv:nucl-th/1804.07593 (2018).

Summary

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