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Extraction of jet-medium interaction details through jet substructure for inclusive and gamma-tagged jets

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Through a comprehensive analysis with Monte Carlo simulations using a multi-stage jet evolution model, we demonstrate that by comparing the jet substructure modifications for inclusive jets and gamma-tagged jets, the virtuality dependence and flavor dependence in jet-medium interactions can be closely examined. Recent findings reveal that a reduction in jet-medium interaction at the early high-virtuality stage, where the jet resolves the medium at a very short distance scale [1], is crucial in explaining single particle energy loss and multiple inclusive jet observables simultaneously [2,3]. In particular, the Soft Drop observables for inclusive jets indicate that medium effects manifest primarily in the very soft components at a later stage, resulting in minimal modification to the hard splitting structure. This behavior is predominantly governed by the characteristics of gluon jets. For quark jets, interactions with the medium in the low virtuality region significantly influence the structure of hard splittings. Reflecting on this, we show that the medium modification of hard-splitting structures is more clearly visible in gamma-jet events via the Soft Drop observables.

[1] A. Kumar, A. Majumder, and C. Shen, PRC 101, 034908 (2020).
[2] A. Kumar et al. (JETSCAPE), PRC 107, 034911 (2023).
[3] Y. Tachibana et al. (JETSCAPE), arXiv:2301.02485.

Category

Theory

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