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Effects of multi-scale jet-medium interactions on jet substructures

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We investigate how the scale-dependent jet-medium interactions affect the jet substructure observables in heavy-ion collisions via event-by-event Monte Carlo simulation using the JETSCAPE framework. Jets are dynamic probes with varying virtualities and energies of partonic constituents in their shower evolution. The various internal medium structures involved in interactions at different scales of the jet parton's virtuality and energy are encoded in the modification of reconstructed jets. Recently, we found that the reduction of jet-medium interaction at the early high-virtuality stage, where the medium is resolved at a very short distance scale and appears more dilute [1], is the key to explaining the different trends in reconstructed jet RAA and single particle RAA in a unified manner [2].

In this study, we focus on jet substructure observables to explore further details of the scale dependence by performing numerical simulations with explicit virtuality dependence in the jet-medium interaction rate within the MATTER+LBT setup of the JETSCAPE framework. We compare results for the Soft Drop groomed observables and jet fragmentation function to data and demonstrate the significant effect of the reduction of jet-medium interaction at the early high-virtuality stage.

[1] Amit Kumar, Abhijit Majumder, and Chun Shen, Phys. Rev. C, 101(3):034908, 2020.

[2] JETSCAPE, arXiv:2204.01163 [hep-ph].

Experiment/Theory

Theory/Phenomenology

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