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Elucidating the internal structure of jets at the LHC using soft-collinear effective theory

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The jet quenching phenomena, observed in heavy ion collisions at the LHC, present strong evidence for the strong modification of parton shower in the quark-gluon plasma. To understanding the longitudinal and transverse structure of medium-induced branching, observables that go beyond the suppression of inclusive and tagged jets are necessary. Here we present theoretical calculations of jet shapes in proton-proton and lead-lead collisions at the LHC using soft-collinear effective theory with Glauber gluon interactions in the medium. We find that large phase space logarithms need to be resummed for precise theoretical predictions. The resummation is performed using renormalization group evolution between different jet scales. We also study the medium modification of the renormalization group evolution and generalize the method to calculate jet shapes in heavy ion collisions. We present a comparison between our calculations with the recent jet shape measurement at the LHC. We also discuss the path to resummation of longitudinal intra-jet observables, such as jet fragmentation functions.

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