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Theoretical interpretation of new jet results from the LHC

IVAN VITEV, Los Alamos National Laboratory

Jets physics in heavy ion reactions is an important new area of active research at Relativistic Heavy Ion Collider and at the Large Hadron Collider that paves the way for novel tests of QCD dynamics in dense nuclear matter. Recently, first results on the quenching of leading particles and jets from the LHC lead-lead run at a center-of-mass energy of 2.76 TeV per nucleon-nucleon pair became available. With this motivation, we present a theoretical analysis of the exciting new experimental findings. We emphasize the accuracy that can be achieved in next-to-leading order perturbative calculations and focus on the suppression the single and double inclusive jet cross sections. We demonstrate how the di-jet asymmetry, recently measured by ATLAS and CMS, can be related to these general results. The case of jets tagged by an electroweak boson is exemplified by the Z_0+jet channel. We discuss the constraints that the inclusive Z_0 measurements by CMS place on cold nuclear matter effects at the LHC. Finally, we clarify the relation between the suppression of inclusive jets, tagged jets and di-jets and the quenching of inclusive particles on the example of the recent ALICE and CMS hadron attenuation data. We conclude by discussing the insights in the in-medium modification of parton showers that the new LHC data provide and point to future directions and effective theories of QCD that can help improve the accuracy of the tools for jet tomography.