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Soft-Collinear Effective theory for hadronic and nuclear collisions: The evolution of jet quenching form RHIC to the highest LHC energies

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Effective field theory (EFT) is a powerful framework based on exploiting symmetries and controlled expansions for problems with a natural separation of energy or distance scales. EFTs are particularly important in QCD and nuclear physics. An effective theory of QCD, ideally suited to jet applications, is Soft-Collinear Effective Theory (SCET). Recently, first steps were taken to extend SCET and describe jet evolution in strongly-interacting matter. In this talk I will demonstrate that the newly constructed theory, called SCETG, allows us for the first time in more than a decade to go beyond the traditional energy loss approximation in heavy ion collisions and unify the treatment of vacuum and medium-induced parton showers. It provides quantitative control over the uncertainties associated with the implementation of the in-medium modification of hadron production cross sections and allows us to accurately constrain the coupling between the jet and the medium. I will further show how SCETG is implemented to present predictions for inclusive hadron suppression in Pb+Pb collisions at the highest LHC energies of 5.1 ATeV and discuss the relative significance of cold and hot nuclear matter effects.

[1] Z.B. Kang, G. Ovanesyan, R. Lashof-Regas, P. Saad, I. Vitev, Phys. Rev. Lett. 114 (2015) 9, 092002

[2] Y.-T. Chien, A. Emerman, Z. Kang, G. Ovanesyan, I. Vitev, JHEP in preparation

On behalf of collaboration:

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