Contribution ID: **822** Type: **Poster**

Precise description of multi-parton correlators in the quark-gluon plasma

Friday 8 April 2022 14:16 (4 minutes)

The high quality experimental data on hard probes in heavy-ion collisions call for a more precise theoretical description of jet evolution in a quark-gluon plasma. To accomplish that we study jet fragmetation via $1 \to 2$ final-state parton splittings in the medium. In earlier works [1,2] the authors have usually calculated these processes by invoking one or two approximations: the large-N_c and the eikonal approximations. We want to develop methods to do the calculations without using these approximations, and to quantify the error that is introduced by employing them.

As partons go through the medium their color continuously rotates, an effect that is encapsulated in a Wilson line resumming multiple medium interactions along their trajectory. When calculating observables, one typically has to calculate medium averages of the traces of two or more Wilson lines, leading to correlators of 2 or more partons extended in time. For 2- or 3-point correlators, analytical solutions exist (at least for soft medium interactions described by a harmonic oscillator potential). However, 4-point correlators are usually dealt with in the literature by invoking the large-N_c limit, but exact calculations have been lacking in many cases. In our work [3], we showed how correlators of multiple Wilson lines appear, and developed a method to calculate them numerically to all orders in N_c. This result is quite general, and can be used to calculate Wilson line correlators that appear in many areas of particle physics.

In our previous paper, though, we made use of the eikonal approximation, meaning that the partons are assumed to travel in straight lines through the medium. This is a good approximation for hard, balanced splittings. For soft and imbalanced splittings the produced partons can be kicked around by the medium, which is described mathematically by a path integral. We show how the full problem can be transformed into solving a set of coupled Schrödinger equations describing a set of mutually interacting color representations, with the aforementioned Wilson line correlators acting as the potential term. These results are relevant for high-p_T jet processes, multi-gluon emissions in the QGP [4] and initial stage physics [5] at the LHC.

[1] F. Dom´ınguez, J. G. Milhano, C. A. Salgado, K. Tywoniuk, and V. Vila, "Mapping collinearin-medium parton splittings,"The European Physical Journal C, vol. 80, Jan 2020.
[2] J.-P. Blaizot, F. Dominguez, E. Iancu, and Y. Mehtar-Tani, "Medium-induced gluon branch-ing,"Journal of High Energy Physics, vol. 2013, Jan 2013.
[3] J. H. Isaksen and K. Tywoniuk, "Wilson line correlators beyond the large-Nc,"JHEP, vol. 21,p. 125, 2020.
[4] P. Arnold, T. Gorda, and S. Iqbal, "The LPM effect in sequential bremsstrahlung: nearlycomplete results for QCD,"JHEP, vol. 11, p. 053, 2020
[5] T. Lappi, H. M¨antysaari, and A. Ramnath, "Next-to-leading order Balitsky-Kovchegov equa-tion beyond largeNc,"Phys. Rev. D, vol. 102, no. 7, p. 074027, 2020.

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Session Classification: Poster Session 3 T12_2

Track Classification: New theoretical developments