Beitrag ID: **305** Typ: **Talk**

Jet evolution in a dense medium beyond multiple soft scattering approximation

Dienstag, 28. März 2023 11:30 (20 Minuten)

In a series of recent publications [1,2,3], we have proposed a factorized approach, based on perturbative QCD, for the evolution of a jet in a dense quark-gluon plasma, together with its implementation as a Monte-Carlo parton shower and successful applications to the phenomenology of jet quenching.
In the original formulation of the parton shower, the collisions between the jet constituents and those of the plasma have been treated in the multiple soft scattering approximation, thus neglecting important effects from single hard scattering. In this new work [4], we extend our Monte Carlo by including the effects of single scattering both on the transverse momentum broadening and on the spectrum for medium-induced radiation. To that aim, the medium-induced cascade is simulated in full 3+1 dimensions and collisions are generated dynamically. This allows us to complete the BDMPS-Z sector of the spectrum for medium-induced radiation with the GLV (Gyulassy-Levai-Vitev) tail at high energies and the Bethe-Heitler spectrum at low energies. Finally, we discuss the impact of single hard scattering on jet substructure observables like the $k_{t,g}$-distribution after Soft Drop, as measured by the ALICE Collaboration.

Refs:
[1] Caucal, Iancu, Mueller, Soyez, PRL 120 (23), 232001
[2] Caucal, Iancu, Soyez, JHEP 2019 (10), 1-55
[3] Caucal, Iancu, Soyez, JHEP 2021 (4), 1-38
[4] Caucal, Iancu, Soyez, in preparation.

Experiment/Theory

Theory/Phenomenology

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Sitzung Einordnung: Parallel: Jets and their modification in QCD Matter

Track Klassifizierung: Jets and their modification in QCD matter