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Jets are modified at both high and low virtuality

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Jet modification is a multi-stage (multi-scale) process: an initial high virtuality stage gives way to a lower virtuality transport stage for high energy partons, and a strongly coupled phase for lower energy parts of the shower. The transition from the high virtuality medium-modified DGLAP stage takes place when the virtuality reaches the medium induced scale $\hat{q}\tau$, where τ is the lifetime of a given parton. A recent outstanding dispute has arisen on the role of energy loss in the high virtuality phase, and its contribution to jet observables [1,2]. In this presentation, we demonstrate that in a realistic dynamically evolving medium, the effect of the higher virtuality stage on leading hadron suppression is comparable or dominant to the lower virtuality stages. This is due to the fact that, for most jets, $\hat{q}$ scales with entropy density, and thus falls faster than the virtuality of the leading partons. As a result, the combined lifetime of partons with virtuality larger than the medium induced scale is sufficiently long that these partons scatter with the plasma multiple times before reaching the medium scale.

To systematically address this, we derive the complete next-to-leading twist single gluon emission contribution. Going beyond previous work, we include higher-twist contributions from both the modulus of the amplitude and the phase in interference terms. We also include all momentum fraction (y) suppressed contributions from quark scattering prior to emission. This calculation allows us to successfully address the issues raised in the work by Aurenche et al. [3,4]. Based on this formalism, a Monte-Carlo framework (MATTER+LBT+hydrodynamics) is further developed for simulating parton showers through the QGP. We demonstrate that while the medium-modified DGLAP process dominates jet observables at high p_T, the subsequent near-on-shell transport process dominates at low p_T. Only by combining these two stages can we naturally obtain a simultaneously good description of the nuclear modification factors of hadrons and jets.

References:
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Collaboration (if applicable)

Track

Jets and High Momentum Hadrons

Contribution type

Contributed Talk

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