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Medium-induced modifications of color flow in high transverse momentum processes

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Heavy ion collisions at both RHIC and the LHC show strong medium-induced modifications of high-pT single inclusive hadron spectra, jet-like particle correlations and reconstructed jets.
A dynamical understanding of these jet quenching phenomena is typically sought within a partonic picture in which the energy of highly energetic parent partons is degraded due to
multiple inelastic and/or elastic interactions inside QCD matter.
In the current model implementations of this parton energy loss the hadronization process is unaffected by it on account that for sufficiently energetic projectiles time dilation should guarantee their hadronization outside the medium.
However, as it has been pointed out before, the interaction of a colored parton with a QCD medium modifies the color flow of the parton shower and arguably can imprint on the hadronization process at much higher transverse momentum than estimated previously.
In this context, we present here the first QCD-based calculation of medium-induced color flow.
Decomposing the multiple scattering diagrams of the BDMPS-Z formalism for parton energy loss into color-singlet 'prehadronic' systems, we observe that (in comparison to vacuum fragmentation) medium-induced effects do not only degrade the longitudinal momentum of these color-singlet systems but also strongly enhance their invariant mass. The larger the invariant mass of a color-singlet at the end of
the perturbative evolution, the more likely it is for such system to decay into a larger number of hadronic fragments and thus leave a smaller fraction of the total available energy to the leading hadron.
Therefore, for multi-partonic states that show the same kinematic distributions at the end of the perturbative evolution, medium-modified color flow can be a significant additional source of
medium-induced multiplicity increase and medium-induced degradation of the leading hadron.
We illustrate this general observation in simple models. We also identify a color flow specific formation time argument that indicates that effects of color-flow induced additional suppression
can persist over transverse energies up to tens of GeV, and may contribute to an enhanced slope of the nuclear modification factor.

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