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Probabilistic picture for in-medium jet evolution

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We study the evolution of a high energy jet triggered by its interactions with a dense QCD medium. We show that the relatively components of the jet which propagate at large angles can be described as the products of a classical branching process, in which successive branchings proceed independently from each other. This exploits the fact that the in-medium rescattering is very efficient in destroying the color coherence between the soft emitted partons: this coherence is washed out already during the branching process, that is, over time scales which are much shorter than the size L of the medium. This allows us to construct a master equation for the generating functional encoding all the intra-jet multi-parton distributions (that is, the distributions in energies and in angles).
The 'jet quenching parameter' $\hat{q}$, which is the only medium-dependent parameter in this description, receives large radiative corrections from a different type of radiation — namely, from hard gluon emissions which are triggered by a single scattering in the medium and occur on time scales much shorter than the typical branching time alluded to above.These radiative corrections, enhanced by a double logarithm $\alpha_s \log^2(LT)$ with T the temperature of the medium, are strongly ordered and overlapping in formation time. We show that these coherent branchings can be absorbed into a renormalization of the jet quenching parameter without spoiling the probabilistic picture mentioned above and which involves only incoherent branchings.

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