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A probabilistic picture for in-medium jet evolution

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We study the perturbative evolution of a jet via multiple gluon emissions induced by the interactions between the jet constituents and a dense QCD medium like a quark-gluon plasma. We focus on the typical medium-induced gluons emissions, for which the gluon formation time is much smaller than the overall size of the medium. We show that the typical time between two subsequent emissions is parametrically larger than the formation time for one gluon (in contrast to jet fragmentation in the vacuum, where these two scales get identified with each other). This separation of scales has a remarkable physical consequence: it implies that coherence phenomena are negligible and therefore successive emissions can be treated as independent from each other and ordered in time. This is important as it allows for a probabilistic interpretation of the in-medium jet fragmentation as a classical branching process, which is in particular suitable for implementation as an event generator.

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