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Towards a consistent description of in-medium parton branching

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Ultra-relativistic heavy-ion collisions are a window of opportunity to study QCD matter under extreme conditions of temperature and density, such as the quark-gluon plasma. Among the several possibilities, the study of jet quenching - generic name given to in-medium energy loss modifications of the parton branching - is a powerful tool to assess the properties of this new state of matter. The description of the parton shower is very well understood in vacuum (controlled reference) and medium-induced modifications of this process can be experimentally accessed through jet measurements. Current experimental data, however, cannot be entirely explained only with energy loss phenomena. Transverse momentum broadening and decoherence effects, both theoretically established by now, are necessary to fully explain the current jet-related observables. Nonetheless, the interplay between these phenomena is essential to build a consistent picture of the medium-modifications of the parton branching and to achieve a correct description of the current experimental data. In this talk, I will present the latest developments that address such unified description

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