In-medium parton branching beyond eikonal approximation

The description of the in-medium modifications of partonic showers has been at the forefront of current theoretical and experimental efforts. Its understanding provides an unique laboratory to extend our knowledge frontier of the theory of the strong interactions, and to assess the properties of the hot and dense medium (QGP) that is produced in ultra-relativistic heavy-ion collisions at RHIC and the LHC. The theory of jet quenching, a commonly used alias for the modifications of the parton branching resulting from the interactions with the QGP, has been significantly developed over the last years. Within a weak coupling approach, several elementary processes that build up the parton shower evolution, such as single gluon emissions, interference effects between successive emissions and corrections to radiative energy loss from massive quarks, have been addressed both at eikonal accuracy and beyond by taking into account the Brownian motion that high-energy particles experience when traversing a hot and dense medium. In this work, by using the setup of single gluon emission from a color correlated quark-antiquark pair in a singlet state (q-qbar antenna), we calculate the in-medium gluon radiation spectrum beyond the eikonal approximation. The results show that we are able to factorize broadening effects from the modifications of the radiation process itself. This constitutes the final proof that a probabilistic picture of the parton shower evolution holds even in the presence of a QGP.