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Medium-induced gluon radiation beyond the eikonal approximation

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In this work we improve existing calculations of radiative energy loss by computing corrections that implement energy-momentum conservation, previously only implemented a posteriori, in a rigorous way. Using the path-integral formalism, we compute in-medium splittings allowing transverse motion of all particles in the emission process, thus relaxing the assumption that only the softest particle is permitted such movement. This work constitutes the extension of the computation carried out for $x \longrightarrow 1$ in Phys. Lett. B718 (2012) 160-168, to all values of x, the momentum fraction of the energy of the parent parton carried by the emitted gluon. In order to accomplish a general description of the whole in-medium showering process, in this work we allow for arbitrary formation times for the emitted gluon (the limit of small formation times was previously employed in [J.-P. Blaizot, F. Dominguez, E. Iancu, and Y. Mehtar-Tani, JHEP1301 (2013) 143], for the $g \longrightarrow gg$ splitting). We provide general expressions and their realisation in the path integral formalism within the harmonic oscillator approximation.

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