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Gluon emission from heavy quarks in dense nuclear medium

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We study the medium-induced gluon emission process experienced by a hard jet parton propagating through the dense nuclear matter in the framework of deep inelastic scattering off a large nucleus. We work beyond the collinear rescattering expansion and the soft gluon emission limit, and derive a closed formula for the medium-induced single gluon emission spectrum from a heavy or light quark jet interacting with the dense nuclear medium via transverse and longitudinal scatterings. Without performing the collinear rescattering expansion, the medium-induced gluon emission spectrum is controlled by the full distribution of the differential elastic scattering rates between the propagating partons and the medium constituents. We then use two different models, heavy static scattering centers and the effective HTL dynamical medium, to characterize the traversed nuclear matter. If one utilizes heavy static scattering centers and takes the soft gluon emission limit, our result can reduce to the first order in opacity Djordjevic-Gyulassy-Levai-Vitev formula (with zero mass for radiated gluon). If we take the effective HTL spectral functions for the exchanged gluon field correlation, our result with similar approximations can reduce to Djordjevic-Heinz formula for medium-induced gluon emission in dynamical QCD medium (with zero thermal mass for radiated gluon).

[1] Le Zhang, De-Fu Hou, Guang-You Qin, arXiv:1812.11048 [hep-ph].
[2] Le Zhang, De-Fu Hou, Guang-You Qin, Phys.Rev. C98 (2018) no.3, 034913, arXiv:1804.00470 [nucl-th].

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