Energy Loss of hard partons in nuclear matter

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\section*{Abstract}

Medium-induced gluon radiation off hard partons is the dominant source of hard parton energy loss in relativistic heavy ion collisions. We present a quantitative study in the framework of multiple soft rescattering. Two qualitatively new effects are reported:

i) The destructive interference between hard (vacuum) and medium-induced gluon radiation results in significant deviations from the BDMPS-L\textsuperscript{2}-behaviour: it even leads to a \textit{negative} medium-induced energy loss $\Delta E \approx -L^3$ for small in-medium pathlength.

ii) Rescattering modifies the medium-induced gluon distribution such that the medium-induced energy loss outside a fixed angular cone can be larger than the total medium-induced radiative energy loss.

We explain in detail how these features lead to an increased sensitivity of radiative energy loss on the rescattering properties of nuclear matter and how they allow to discriminate between QGP and non-QGP scenarios. Comparing different observables in p-A and A-A collisions, we discuss implications of our calculations for RHIC and LHC.