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The medium-modified $g \to c\bar{c}$ splitting function in the BDMPS-Z formalism

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The formalism of Baier-Dokshitzer-Mueller-Peigné-Schiff and Zakharov determines the modifications of parton splittings in the QCD plasma that arise from medium-induced gluon radiation. Here, we study medium-modifications of the gluon splitting into a quark–anti-quark pair in this BDMPS-Z formalism. We derive a compact path-integral formulation that resums effects from an arbitrary number of interactions with the medium to leading $\mathcal{O}(1/N_c^2)$. Analyses in the $N = 1$ opacity and the saddle point approximations reveal two phenomena: a medium-induced momentum broadening that increases the invariant mass of quark–anti-quark pairs, and a medium-enhanced production of such pairs. We note that both effects are numerically sizeable if the average momentum transfer from the medium is comparable to the quark mass. In ultra-relativistic heavy-ion collisions, this condition is satisfied for charm quarks. We therefore focus our numerical analysis on the medium modification of $g \to c\bar{c}$, although our derivation applies equally well to $g \to b\bar{b}$ and to gluons splitting into light-flavoured quark–anti-quark pairs.

Declaration

I certify that I have checked that I am authorised to submit the abstract with the listed co-authors with their current affiliations

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