

Soft-gluon effective coupling and cusp anomalous dimension

Monday, September 9, 2019 12:00 PM (25 minutes)

We consider the extension of the CMW soft-gluon effective coupling beyond the next-to-leading logarithmic accuracy. We present two proposals of a soft-gluon effective coupling that extend the CMW coupling to all perturbative orders. Although both effective couplings are well-defined in four dimensions, we examine their behaviour in $d=4-2\epsilon$ dimensions. We uncover an all-order perturbative relation with the cusp anomalous dimension: the (four dimensional) cusp anomalous dimension is equal to the d -dimensional soft-gluon effective coupling at the conformal point $\epsilon=\beta(\alpha_s)$, where the d -dimensional QCD beta-function, vanishes. We present the explicit expressions of the two soft-gluon couplings up to $O(\alpha_s^2)$ in d dimensions. In the four-dimensional case we compute the two soft couplings up to $O(\alpha_s^3)$. For one of the two couplings, we confirm the $O(\alpha_s^3)$ result previously presented by other authors. For the other coupling, we obtain the explicit relation with the cusp anomalous dimension up to $O(\alpha_s^4)$. We comment on Casimir scaling at $O(\alpha_s^4)$.

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