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Erratum: QCD evolution of (un)polarized gluon TMDPDFs and the Higgs q_T -distribution

Miguel G. Echevarria,^{a,b} Tomas Kasemets,^{a,b} Piet J. Mulders^{a,b} and Cristian Pisano^{a,b,c}

^a*Nikhef Theory Group,*

Science Park 105, 1098XG Amsterdam, The Netherlands

^b*Department of Physics and Astronomy, VU University Amsterdam,*

De Boelelaan 1081, NL-1081 HV Amsterdam, The Netherlands

^c*Department of Physics, University of Antwerp,*

Groenenborgerlaan 171, 2020 Antwerp, Belgium

E-mail: m.g.echevarria@nikhef.nl, kasemets@nikhef.nl,
mulders@few.vu.nl, c.pisano@nikhef.nl

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The definition of the gauge invariant gluon field in eq. (2.4) in [1] should be divided by $\bar{n} \cdot \mathcal{P}$:

$$\mathcal{B}_{n\perp}^\mu = \frac{1}{g} [W_n^\dagger i D_n^\perp W_n] = \frac{1}{\bar{n} \cdot \mathcal{P}} i \bar{n}_\alpha g_{\perp\beta}^\mu W_n^\dagger F_n^{\alpha\beta} W_n = \frac{1}{\bar{n} \cdot \mathcal{P}} i \bar{n}_\alpha g_{\perp\beta}^\mu t^a (\mathcal{W}_n^\dagger)^{ab} F_n^{\alpha\beta,b}. \quad (1)$$

The matching coefficients of the gluon helicity in eq. (5.3) in [1] have been corrected, and they should read:

$$\begin{aligned} \tilde{C}_{g/g}^g &= \frac{\alpha_s}{2\pi} \left[C_A \delta(1-x) \left(-\frac{1}{2} L_T^2 + L_T \ln \frac{\mu^2}{\zeta} - \frac{\pi^2}{12} \right) - L_T \left(\mathcal{P}_{\Delta g/\Delta g} - \delta(1-x) \frac{\beta_0}{2} \right) - 4 C_A (1-x) \right], \\ \tilde{C}_{g/q}^g &= \frac{\alpha_s}{2\pi} \left[-L_T \mathcal{P}_{\Delta g/\Delta q} - C_F 2(1-x) \right]. \end{aligned} \quad (2)$$

Accordingly, figures 1 and 2 in the manuscript [1] should be replaced by figures 1 and 2 in this erratum.

There is a typo in the global sign of the matching coefficients of $h_1^{\perp g}$ in eq. (7.3) in [1], which should be the opposite, consistent with the calculation in the appendix in eq. (B.6) and all the plots where they have been implemented.

In appendix A in [1], the discussion around eqs. (A.5), (A.6) and (A.8) should be replaced by the following more accurate explanation:

When calculating in $d = 4 - 2\epsilon$ dimensions the tensor structures for the unpolarized and linearly polarized TMDPDFs in eq. (A.4), the d -dimensional analogues can be obtained by the replacement $\frac{1}{2}(-g_\perp^{\mu\nu}) \rightarrow \frac{1}{d-2}(-g_\perp^{\mu\nu})$. For the gluon in a gluon helicity matching coefficient there are always two epsilon tensors in each diagram calculation. This product can be rewritten in terms of metric tensors and we use a product of two transverse epsilon tensors in d -dimensions with the normalization

$$\epsilon_{\mu\nu}^\perp \epsilon^{\mu\nu}_\perp = (d-2)(d-3). \quad (3)$$

For the calculation of the gluon in a quark we have to calculate a trace containing one γ_5 . This is done through the identification $\text{Tr}(\gamma^\mu \gamma^\nu \gamma^\alpha \gamma^b \gamma_5) \rightarrow -4i\epsilon^{\mu\nu\alpha\beta}$ in order to once again obtain the product of two epsilon tensors. For a calculation of the matching coefficients in a different scheme and a more careful treatment of γ_5 and the epsilon tensor, we refer the reader to [2, 3].

There is a factor $x p^+$ missing in the integrand in the first line of eqs. (A.12), (A.27), (A.31), (B.1), (B.2), (C.4) and (C.5) in [1].

A factor x is missing in eqs. (A.16), (A.20), (A.26), (A.31) and (A.32) in [1] in the term that has the plus distribution of a logarithm. It should be replaced as follows:

$$\left(\frac{\ln(1-x)}{1-x} \right)_+ \longrightarrow x \left(\frac{\ln(1-x)}{1-x} \right)_+.$$

The projector in d dimensions in eqs. (B.1) (second line) and (B.2) (last factor in the second line) in [1] should be replaced as:

$$2 \left(\frac{g_{\perp\mu\nu}}{2} - \frac{(p-k)_\perp\mu (p-k)_\perp\nu}{(p-k)_\perp^2} \right) \longrightarrow \frac{d-2}{d-3} \left(\frac{g_{\perp\mu\nu}}{(d-2)} - \frac{(p-k)_\perp\mu (p-k)_\perp\nu}{(p-k)_\perp^2} \right).$$

Figure 1. The gluon helicity TMDPDF g_{1L}^g at $Q = 20$ GeV, $x = 0.01$ and with the non-perturbative parameters chosen to be $\lambda_g = 0.3$ and $\lambda_Q = 0.1$. The bands come from varying independently both the resummation scale μ_0 and the rapidity scale ζ_0 by a factor of 2 around their default value, and taking the maximum variation.

Figure 2. The gluon helicity TMDPDF g_{1L}^g at $x = 0.01$ for different values of the evolution scale and the non-perturbative parameters, at $\sqrt{s} = 8$ TeV. All curves are given at NNLL accuracy.

Notice that we have replaced a factor 2 by $d - 2$, which makes this projector orthogonal to the one for the unpolarized TMDPDF ($g_{\mu\nu}^\perp$ in eq. (A.4)) in d dimensions, while the $(d - 2)/(d - 3)$ factor is a normalization factor necessary to single out the linearly polarized TMDPDF. However, these changes are not relevant at this perturbative order, since there are no poles in ϵ .

In order to be consistent with the explanation around eq. (3) in this erratum, in eqs. (C.1), (C.2) and (C.4) one should do this replacement in the integrands:

$$[\epsilon_\mu(p; +)\epsilon_\nu^*(p; +) - \epsilon_\mu(p; -)\epsilon_\nu^*(p; -)] \longrightarrow -i\epsilon_{\mu\nu}^\perp,$$

and also add the following factor in the integrand of eq. (C.5): $2/((d - 2)(d - 3))$.

The following finite term is missing in eq. (C.15) in [1]: $+\frac{\alpha_s C_A}{\pi} 2(1 - x)$. And accordingly, also in eq. (C.16): $+\frac{\alpha_s C_A}{2\pi} 4(1 - x)$.

The following finite term is missing in eq. (C.17) in [1]: $+\frac{\alpha_s C_F}{2\pi} (2 - x)$.

Finally, the correct matching coefficients for the gluon helicity TMDPDF in eqs. (C.18) and (C.19) in [1] should read as in eq. (2) in this erratum.

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