Physics Letters B 778 (2018) 464

Contents lists available at ScienceDirect

Physics Letters B

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Corrigendum

Corrigendum to "Threshold expansion of the $gg(q\bar{q}) \to Q\,\overline{Q} + X$ cross section at $\mathcal{O}(\alpha_s^4)$" [Phys. Lett. B 690 (2010) 483–490]

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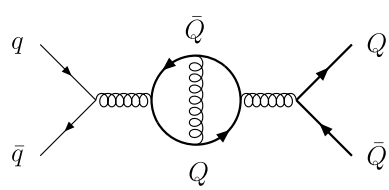
Ref. [1] noted that there is an additional contribution to the singular terms in the threshold expansion of the heavy-quark pair production cross section at $\mathcal{O}(\alpha_s^4)$ from the one-particle reducible vacuum polarization contribution



to the 2-loop virtual correction, which was omitted in our calculation. This affects only the quark–antiquark production channel $q\bar{q} \to Q\,\bar{Q}$. In consequence the expression

$$\sigma^{(2,0)}_{q\bar{q},\mathbf{8}}\Big|_{\mathrm{VP}} = \left(C_F - \frac{C_A}{2}\right) 8\pi^2 \ln\beta = -13.160 \ln\beta$$

must be added to Eq. (5), which changes the coefficient of the $\ln\beta$ term in Eq. (8) from 528.557 to 515.397. Eq. (8) should read correctly

$$\sigma^{(2)}_{q\bar{q}} = \frac{3.60774}{\beta^2} + \frac{1}{\beta}\Big(-140.368 \ln^2\beta + 32.106 \ln\beta + 3.95105\Big)$$
$$+910.222 \ln^4\beta - 1315.53 \ln^3\beta + 592.292 \ln^2\beta$$
$$+515.397 \ln\beta + C^{(2)}_{q\bar{q}}\,.$$

The new term amounts to a reduction of the coefficient of $\ln\beta$ by 2.5%. The numerical effect on the total cross section is negligible.

As discussed in Ref. [2] in the more general context of pair production of squarks and gluinos, the above additional term should be interpreted as a correction to the "Coulomb function" $J_{R_\alpha}(E)$ in Eq. (1) from an annihilation contribution, here from $Q\,\bar{Q} \to Q\,\bar{Q}$, to the NRQCD Lagrangian. Accordingly, the term

$$\nu^{R_\alpha,S}_{\mathrm{ann}}(-D_{R_\alpha})\, 8\pi^2 \ln\beta$$

should be added to the general result for $\sigma^{(2)}_X$ in Eq. (A.1). For a given heavy-particle state, $\nu^{R_\alpha,S}_{\mathrm{ann}}$ depends on the colour representation R_α and total spin S of the pair. For $Q\,\bar{Q}$, only $\nu^{\mathbf{8},1}_{\mathrm{ann}} = 2T_F = 1$ is different from zero. Results for $\nu^{R_\alpha,S}_{\mathrm{ann}}$ as well as the quantity ν_{spin}, which appears in Eq. (A.1), can be found in Ref. [2] for the case of pair production of squarks and gluinos.

References

[1] P. Bärnreuther, M. Czakon, P. Fiedler, J. High Energy Phys. 1402 (2014) 078, arXiv:1312.6279 [hep-ph].
[2] M. Beneke, J. Piclum, C. Schwinn, C. Wever, J. High Energy Phys. 1610 (2016) 054, arXiv:1607.07574 [hep-ph].

DOI of original article: https://doi.org/10.1016/j.physletb.2010.05.038.

https://doi.org/10.1016/j.physletb.2018.02.041
0370-2693