

$$I_4^{\{D=4-2\epsilon\}}(m^2, 0, 0, m^2; t, s; 0, m^2, m^2, m^2)$$

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This is the integral taken from ref. [1] where $\beta = \sqrt{(1 - \frac{4m^2}{s})}$ and $\lambda_{\pm} = \frac{1}{2}(1 \pm \beta)$. The expression is valid in the unphysical region, $s, t < 0, m^2 > 0$ so that $\beta > 1, \lambda_+ > 1, \lambda_- < 0$

$$\begin{aligned} & I_4^{\{D=4-2\epsilon\}}(0, m^2, m^2, 0; t, s; 0, m^2, m^2, m^2) \\ &= \frac{1}{s(t - m^2)\beta} \left(\frac{\mu^2}{m^2}\right)^{\epsilon} \left[\frac{1}{\epsilon} \ln\left(\frac{\beta - 1}{\beta + 1}\right) - \ln\left(\frac{\beta - 1}{\beta + 1}\right) \left(2 \ln\left(\frac{m^2 - t}{m^2}\right) - \ln\left(\frac{-s}{m^2}\right)\right) \right. \\ & \left. + 2 \text{Li}_2\left(\frac{-\lambda_-}{\lambda_+}\right) + 2 \text{Li}_2(-\lambda_-/\beta) + \ln^2(-\beta/\lambda_-) - \frac{\pi^2}{2} \right] + \mathcal{O}(\epsilon) \end{aligned}$$

See the file on **notation**.

This integral has also been given in Eq. (A3) of ref. [2] (note differing definition of ϵ) and Eq. (6.69) of ref [3]. Their result for the real value of the integral for $s > 4m^2, 0 < x < 1, t < 0$ is,

$$x = \frac{1 - \beta}{1 + \beta}$$

$$\begin{aligned} I_4^{\{D=4-2\epsilon\}}(m^2, 0, 0, m^2; t, s; 0, m^2, m^2, m^2) &= \frac{1}{s(t - m^2)\beta} \left(\frac{\mu^2}{m^2}\right)^{\epsilon} \left[\frac{1}{\epsilon} \ln x - 2 \ln x \ln(1 - x) + 2 \ln x \ln(1 + x) \right. \\ & \left. - 2 \ln x \ln\left(\frac{m^2 - t}{m^2}\right) - 2 \text{Li}_2(x) + 2 \text{Li}_2(-x) - \frac{\pi^2}{2} \right] \end{aligned}$$

Information about terms of order ϵ and ϵ^2 can be obtained in ref. [4].

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References

- [1] P. Nason, S. Dawson and R. K. Ellis, (unpublished)

- [2] W. Beenakker, H. Kuijf, W. L. van Neerven and J. Smith, Phys. Rev. D **40**, 54 (1989). [Inspire](#)
- [3] R. Höpker, Hadroproduction and decay of squarks and gluinos, (in german), DESY Internal report DESY-T-96-02, ([Relevant excerpt](#))
- [4] J. G. Korner, Z. Merebashvili and M. Rogal, Phys. Rev. D **71**, 054028 (2005) [[arXiv:hep-ph/0412088](#)]
see also [for a report on the formula in this paper in Mathematica Format](#)