

$$I_4^{\{D=4-2\epsilon\}}(m^2, 0, p_3^2, m^2; s_{12}, s_{23}; 0, m^2, m^2, m^2)$$

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Integral obtained from Eq.(A4), Equation 5 of ref. [1]

$$\begin{aligned} I_4^{\{D=4-2\epsilon\}}(m^2, 0, p_3^2, m^2; s_{12}, s_{23}; 0, m^2, m^2, m^2) &= \left(\frac{\mu^2}{m^2}\right)^\epsilon \frac{1}{(s_{12} - m^2)s_{23}\beta_{s_{23}}} \\ &\times \left[\frac{1}{\epsilon} \ln(x_{s_{23}}) - 2 \sum_{\rho=\pm 1} \mathcal{L}i_2(x_{s_{23}}, x_{p_3^\rho}) - \text{Li}_2(x_{s_{23}}^2) - 2 \ln(x_{s_{23}}) \ln(1 - x_{s_{23}}^2) \right. \\ &\quad \left. - 2 \ln(x_{s_{23}}) \ln\left(1 - \frac{s_{12}}{m^2}\right) - \ln^2(x_{p_3^2}) + \frac{\pi^2}{6} \right] + \mathcal{O}(\epsilon) \end{aligned}$$

See the file on [notation](#). We make use of the quantities

$$\beta_r = \sqrt{1 - \frac{4m^2}{r}}, \quad x_r = \frac{\beta_r - 1}{\beta_r + 1},$$

where r represents a generic invariant. Analytic continuation by the replacements $s_{ij} \rightarrow s_{ij} + i\epsilon, p_j^2 \rightarrow p_j^2 + i\epsilon$.

The following specific combination of logarithms and dilogarithms was used,

$$\mathcal{L}i_2(x, y) = \text{Li}_2(1 - xy) + \ln(1 - xy) \left[\ln(xy) - \ln(x) - \ln(y) \right],$$

See also ref. [2], Eq. (16)

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References

- [1] W. Beenakker, S. Dittmaier, M. Kramer, B. Plumper, M. Spira and P. M. Zerwas, Nucl. Phys. B **653**, 151 (2003) [[arXiv:hep-ph/0211352](#)]. [[arXiv:hep-ph/0211352](#)]
- [2] G. Rodrigo, A. Santamaria and M. S. Bilenky, J. Phys. G **25**, 1593 (1999) [[arXiv:hep-ph/9703360](#)]