Divergent Box Integral 8: $I_4^{\{D=4-2\epsilon\}}(0,0,p_3^2,p_4^2;s_{12},s_{23};0,0,0,m^2)$

Page contributed by R.K. Ellis

The result for this box (see figure). The expression is valid for $s_{12}, s_{23}, p_3^2, p_4^2 < 0$ and $m^2 > 0$.

$$
\begin{aligned}
I_4^{\{D=4-2\epsilon\}}(0,0,p_3^2,p_4^2;s_{12},s_{23};0,0,0,m^2) \; = \; & \frac{1}{s_{12}(s_{23}-m^2)}\Bigg[\frac{1}{\epsilon^2}-\frac{1}{\epsilon}\left[\ln\frac{-s_{12}}{\mu^2}+\ln\frac{(m^2-s_{23})^2}{(m^2-p_3^2)(m^2-p_4^2)}\right] \\
& -2\,\mathrm{Li}_2\left(1-\frac{m^2-p_3^2}{m^2-s_{23}}\right)-2\,\mathrm{Li}_2\left(1-\frac{m^2-p_4^2}{m^2-s_{23}}\right)-\mathrm{Li}_2\left(1+\frac{(m^2-p_3^2)(m^2-p_4^2)}{s_{12}m^2}\right) \\
& -\frac{\pi^2}{6}+\frac{1}{2}\ln^2\left(\frac{-s_{12}}{\mu^2}\right)-\frac{1}{2}\ln^2\left(\frac{-s_{12}}{m^2}\right)+2\ln\left(\frac{-s_{12}}{\mu^2}\right)\ln\left(\frac{m^2-s_{23}}{m^2}\right) \\
& -\ln\left(\frac{m^2-p_3^2}{\mu^2}\right)\ln\left(\frac{m^2-p_3^2}{m^2}\right)-\ln\left(\frac{m^2-p_4^2}{\mu^2}\right)\ln\left(\frac{m^2-p_4^2}{m^2}\right)\Bigg]+\mathcal{O}(\epsilon).
\end{aligned}
$$

Integral obtained from Eq.(B6) of ref. [**?**]

Analytic continuation by the replacements $s_{ij} \to s_{ij}+i\varepsilon, p_j^2 \to p_j^2+i\varepsilon$.

The integral $I_4^{\{D=4-2\epsilon\}}(0,0,m_1^2,m_1^2;s_{12},s_{23};0,0,0,m^2)$ given in Höpker Eq. (6.71) is obtainable taking the limit $p_3^2=p_4^2=m_1^2$. Return to general page on boxes

References

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[2] R. Höpker, Hadroproduction and decay of squarks and gluinos, (in german), DESY Internal report DESY-T-96-02, (Relevant excerpt)