

$$\begin{aligned}
& C_{qq}^{(1)} 11_{-12} 13_{-14} \rightarrow \hbar \left( \frac{1}{1296} \frac{1}{m_e^2} (-81 s_Y^2 c_Y^2 \overline{y_d}^{i2p} \overline{y_d}^{i4r} y_d^{i1p} y_d^{i3r} + \right. \\
& \quad s_Y^2 \overline{y_d}^{i4p} (y_d^{i3p} (162 c_Y^2 \overline{y_u}^{i2r} y_u^{i1r} + (5 g_1^2 + 24 g_3^2) \delta_{i1i2}) - 36 g_3^2 y_d^{i1p} \delta_{i2i3}) - c_Y^2 \\
& \quad \left. (\overline{y_u}^{i4p} y_u^{i3p} (13 g_1^2 - 24 g_3^2) \delta_{i1i2} + 9 y_u^{i1p} (9 s_Y^2 \overline{y_u}^{i2p} \overline{y_u}^{i4r} y_u^{i3r} + 4 g_3^2 \overline{y_u}^{i4p} \delta_{i2i3})) \right) + \\
& \frac{1}{36} g_3^4 (3 \delta_{i1i4} \delta_{i2i3} - 2 \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,0}[m_3] + \frac{1}{24} g_3^4 (3 \delta_{i1i4} \delta_{i2i3} - 2 \delta_{i1i2} \delta_{i3i4}) \text{LF}_{4,-1}[m_3] + \\
& \frac{2}{45} g_3^4 (-3 \delta_{i1i4} \delta_{i2i3} + 2 \delta_{i1i2} \delta_{i3i4}) \text{LF}_{5,-2}[m_3] + \\
& \frac{1}{972} \sum_p (27 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 (g_1^4 - 9 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,0}[m_d^p] - \\
& \frac{5}{2592} \sum_p (27 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 (g_1^4 - 9 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{4,-1}[m_d^p] + \\
& \frac{1}{1215} \sum_p (27 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 (g_1^4 - 9 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{5,-2}[m_d^p] + \\
& \frac{1}{162} \sum_p g_1^4 \text{LF}_{3,0}[m_e^p] \delta_{i1i2} \delta_{i3i4} - \frac{5}{432} \sum_p g_1^4 \text{LF}_{4,-1}[m_e^p] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{2}{405} \sum_p g_1^4 \text{LF}_{5,-2}[m_e^p] \delta_{i1i2} \delta_{i3i4} + \frac{1}{324} \sum_p g_1^4 \text{LF}_{3,0}[m_l^p] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{5}{864} \sum_p g_1^4 \text{LF}_{4,-1}[m_l^p] \delta_{i1i2} \delta_{i3i4} + \frac{1}{405} \sum_p g_1^4 \text{LF}_{5,-2}[m_l^p] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{972} \sum_p (54 g_3^4 \delta_{i1i4} \delta_{i2i3} + (g_1^4 - 36 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,0}[m_q^p] - \\
& \frac{5}{2592} \sum_p (54 g_3^4 \delta_{i1i4} \delta_{i2i3} + (g_1^4 - 36 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{4,-1}[m_q^p] + \\
& \frac{1}{1215} \sum_p (54 g_3^4 \delta_{i1i4} \delta_{i2i3} + (g_1^4 - 36 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{5,-2}[m_q^p] + \\
& \frac{1}{972} \sum_p (27 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 (4 g_1^4 - 9 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,0}[m_u^p] - \\
& \frac{5}{2592} \sum_p (27 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 (4 g_1^4 - 9 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{4,-1}[m_u^p] + \\
& \frac{1}{1215} \sum_p (27 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 (4 g_1^4 - 9 g_3^4) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{5,-2}[m_u^p] + \\
& \frac{1}{216} (27 s_Y^2 c_Y^2 \overline{y_d}^{i2p} \overline{y_d}^{i4r} y_d^{i1p} y_d^{i3r} + \\
& \quad 2 s_Y^2 \overline{y_d}^{i4p} (y_d^{i3p} (27 c_Y^2 \overline{y_u}^{i2r} y_u^{i1r} + 2 (g_1^2 + 3 g_3^2) \delta_{i1i2}) - 9 g_3^2 y_d^{i1p} \delta_{i2i3}) + c_Y^2 \\
& \quad (4 \overline{y_u}^{i4p} y_u^{i3p} (-2 g_1^2 + 3 g_3^2) \delta_{i1i2} + 9 y_u^{i1p} (3 s_Y^2 \overline{y_u}^{i2p} \overline{y_u}^{i4r} y_u^{i3r} - 2 g_3^2 \overline{y_u}^{i4p} \delta_{i2i3})) \bigg) \\
& \text{LF}_{1,2}[m_\oplus] + \frac{1}{144} (9 s_Y^4 \overline{y_d}^{i2p} \overline{y_d}^{i4r} y_d^{i1p} y_d^{i3r} + 9 c_Y^4 \overline{y_u}^{i2p} \overline{y_u}^{i4r} y_u^{i1p} y_u^{i3r} + \\
& \quad 2 g_1^2 c_Y^2 \overline{y_u}^{i4p} y_u^{i3p} \delta_{i1i2} - 2 s_Y^2 \overline{y_d}^{i4p} y_d^{i3p} (9 c_Y^2 \overline{y_u}^{i2r} y_u^{i1r} + g_1^2 \delta_{i1i2})) \text{LF}_{2,1}[m_\oplus] + \\
& \frac{1}{648} g_1^2 (9 s_Y^2 \overline{y_d}^{i4p} y_d^{i3p} - 9 c_Y^2 \overline{y_u}^{i4p} y_u^{i3p} + 2 g_1^2 \delta_{i3i4}) \text{LF}_{3,0}[m_\oplus] \delta_{i1i2} - \\
& \frac{5}{864} g_1^4 \text{LF}_{4,-1}[m_\oplus] \delta_{i1i2} \delta_{i3i4} + \frac{1}{405} g_1^4 \text{LF}_{5,-2}[m_\oplus] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{324} g_1^4 \text{LF}_{3,0}[\tilde{\mu}] \delta_{i1i2} \delta_{i3i4} + \frac{1}{216} g_1^4 \text{LF}_{4,-1}[\tilde{\mu}] \delta_{i1i2} \delta_{i3i4} - \frac{2}{405} g_1^4 \text{LF}_{5,-2}[\tilde{\mu}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{3888} g_1^2 (9 g_3^2 \delta_{i1i4} \delta_{i2i3} + (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,1,0}[m_1, m_q^{i4}] + \\
& \frac{1}{3888} g_1^2 (9 g_3^2 \delta_{i1i4} \delta_{i2i3} + (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,2,-1}[m_1, m_q^{i4}] + \\
& \frac{1}{1944} g_1^2 (-9 g_3^2 \delta_{i1i4} \delta_{i2i3} - (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,1,-1}[m_1, m_q^{i4}] + \\
& \frac{1}{3888} g_1^2 (9 g_3^2 \delta_{i1i4} \delta_{i2i3} + (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{4,1,-2}[m_1, m_q^{i4}] + \\
& \frac{1}{144} g_2^2 (9 g_3^2 \delta_{i1i4} \delta_{i2i3} + (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,1,0}[m_2, m_q^{i4}] + \\
& \frac{1}{144} g_2^2 (9 g_3^2 \delta_{i1i4} \delta_{i2i3} + (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,2,-1}[m_2, m_q^{i4}] + \\
& \frac{1}{72} g_2^2 (-9 g_3^2 \delta_{i1i4} \delta_{i2i3} - (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,1,-1}[m_2, m_q^{i4}] + \\
& \frac{1}{144} g_2^2 (9 g_3^2 \delta_{i1i4} \delta_{i2i3} + (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{4,1,-2}[m_2, m_q^{i4}] + \\
& \frac{1}{648} (-9 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 g_3^2 (4 g_1^2 + 3 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,1,0}[m_3, m_q^{i4}] + \\
& \frac{1}{648} (-9 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 g_3^2 (4 g_1^2 + 3 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,2,-1}[m_3, m_q^{i4}] + \\
& \frac{1}{648} (-225 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 g_3^2 (-8 g_1^2 + 75 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,1,-1}[m_3, m_q^{i4}] + \\
& \frac{1}{81} (9 g_3^4 \delta_{i1i4} \delta_{i2i3} + g_3^2 (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{4,1,-2}[m_3, m_q^{i4}] + \\
& \frac{1}{108} \overline{y_d}^{i4p} (2 y_d^{i3p} (g_1^2 + 3 g_3^2) \delta_{i1i2} - 9 g_3^2 y_d^{i1p} \delta_{i2i3}) \text{LF}_{2,1,0}[m_d^p, \tilde{\mu}] + \\
& \frac{1}{216} \overline{y_d}^{i4p} (-2 y_d^{i3p} (g_1^2 + 3 g_3^2) \delta_{i1i2} + 9 g_3^2 y_d^{i1p} \delta_{i2i3}) \text{LF}_{2,2,-1}[m_d^p, \tilde{\mu}] + \\
& \frac{1}{216} \overline{y_d}^{i4p} (-2 y_d^{i3p} (g_1^2 + 3 g_3^2) \delta_{i1i2} + 9 g_3^2 y_d^{i1p} \delta_{i2i3}) \text{LF}_{3,1,-1}[m_d^p, \tilde{\mu}] + \\
& \frac{1}{1944} g_1^2 (-9 g_3^2 \delta_{i1i4} \delta_{i2i3} - (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,1,0}[m_q^{i4}, m_1] + \\
& \frac{1}{3888} g_1^2 (9 g_3^2 \delta_{i1i4} \delta_{i2i3} + (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,1,-1}[m_q^{i4}, m_1] + \\
& \frac{1}{72} g_2^2 (-9 g_3^2 \delta_{i1i4} \delta_{i2i3} - (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,1,0}[m_q^{i4}, m_2] + \\
& \frac{1}{144} g_2^2 (9 g_3^2 \delta_{i1i4} \delta_{i2i3} + (g_1^2 - 6 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,1,-1}[m_q^{i4}, m_2] + \\
& \frac{1}{324} (9 g_3^4 \delta_{i1i4} \delta_{i2i3} - 2 g_3^2 (4 g_1^2 + 3 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{2,1,0}[m_q^{i4}, m_3] + \\
& \frac{1}{648} (-9 g_3^4 \delta_{i1i4} \delta_{i2i3} + 2 g_3^2 (4 g_1^2 + 3 g_3^2) \delta_{i1i2} \delta_{i3i4}) \text{LF}_{3,1,-1}[m_q^{i4}, m_3] + \\
& \frac{1}{108} \overline{y_u}^{i4p} (2 y_u^{i3p} (-2 g_1^2 + 3 g_3^2) \delta_{i1i2} - 9 g_3^2 y_u^{i1p} \delta_{i2i3}) \text{LF}_{2,1,0}[m_u^p, \tilde{\mu}] + \\
& \frac{1}{216} \overline{y_u}^{i4p} (2 y_u^{i3p} (2 g_1^2 - 3 g_3^2) \delta_{i1i2} + 9 g_3^2 y_u^{i1p} \delta_{i2i3}) \text{LF}_{2,2,-1}[m_u^p, \tilde{\mu}] + \\
& \frac{1}{216} \overline{y_u}^{i4p} (2 y_u^{i3p} (2 g_1^2 - 3 g_3^2) \delta_{i1i2} + 9 g_3^2 y_u^{i1p} \delta_{i2i3}) \text{LF}_{3,1,-1}[m_u^p, \tilde{\mu}] + \\
& \frac{1}{216} \overline{y_d}^{i4p} (-2 y_d^{i3p} (g_1^2 + 3 g_3^2) \delta_{i1i2} + 9 g_3^2 y_d^{i1p} \delta_{i2i3}) \text{LF}_{2,1,0}[\tilde{\mu}, m_d^p] + \\
& \frac{1}{216} \overline{y_d}^{i4p} (y_d^{i3p} (-5 g_1^2 + 12 g_3^2) \delta_{i1i2} - 18 g_3^2 y_d^{i1p} \delta_{i2i3}) \text{LF}_{3,1,-1}[\tilde{\mu}, m_d^p] + \\
& \frac{1}{216} \overline{y_d}^{i4p} (y_d^{i3p} (g_1^2 - 6 g_3^2) \delta_{i1i2} + 9 g_3^2 y_d^{i1p} \delta_{i2i3}) \text{LF}_{4,1,-2}[\tilde{\mu}, m_d^p] + \\
& \frac{1}{216} \overline{y_u}^{i4p} (2 y_u^{i3p} (2 g_1^2 - 3 g_3^2) \delta_{i1i2} + 9 g_3^2 y_u^{i1p} \delta_{i2i3}) \text{LF}_{2,1,0}[\tilde{\mu}, m_u^p] + \\
& \frac{1}{216} \overline{y_u}^{i4p} (y_u^{i3p} (g_1^2 + 12 g_3^2) \delta_{i1i2} - 18 g_3^2 y_u^{i1p} \delta_{i2i3}) \text{LF}_{3,1,-1}[\tilde{\mu}, m_u^p] + \\
& \frac{1}{216} \overline{y_u}^{i4p} (y_u^{i3p} (g_1^2 - 6 g_3^2) \delta_{i1i2} + 9 g_3^2 y_u^{i1p} \delta_{i2i3}) \text{LF}_{4,1,-2}[\tilde{\mu}, m_u^p] + \\
& \frac{1}{2592} g_1^4 \text{LF}_{2,1,1,-1}[m_1, m_q^{i4}, m_q^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{1296} g_1^4 m_1^2 \text{LF}_{2,1,1,0}[m_1, m_q^{i4}, m_q^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{3}{32} g_2^4 \text{LF}_{2,1,1,-1}[m_2, m_q^{i4}, m_q^{i2}] \delta_{i1i2} \delta_{i3i4} + \frac{3}{16} g_2^4 m_2^2 \text{LF}_{2,1,1,0}[m_2, m_q^{i4}, m_q^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{72} g_3^4 \text{LF}_{2,1,1,-1}[m_3, m_q^{i4}, m_q^{i2}] \delta_{i1i2} \delta_{i3i4} + \frac{5}{18} g_3^4 m_3^2 \text{LF}_{2,1,1,0}[m_3, m_q^{i4}, m_q^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{7}{48} g_3^4 \text{LF}_{2,1,1,-1}[m_3, m_q^{i4}, m_q^{i3}] \delta_{i1i4} \delta_{i2i3} - \frac{1}{12} g_3^4 m_3^2 \text{LF}_{2,1,1,0}[m_3, m_q^{i4}, m_q^{i3}] \delta_{i1i4} \delta_{i2i3} + \\
& \frac{1}{4} \tilde{\mu}^2 \overline{y_d}^{i4p} y_d^{i3p} \overline{y_u}^{i2r} y_u^{i1r} \text{LF}_{2,1,1,0}[\tilde{\mu}, m_d^p, m_u^r] + \\
& \frac{1}{16} \overline{y_d}^{i2p} \overline{y_d}^{i4r} y_d^{i1p} y_d^{i3r} \text{LF}_{2,1,1,-1}[\tilde{\mu}, m_d^r, m_d^p] + \frac{1}{16} \overline{y_u}^{i2p} \overline{y_u}^{i4r} y_u^{i1p} y_u^{i3r} \\
& \text{LF}_{2,1,1,-1}[\tilde{\mu}, m_u^r, m_u^p] - \frac{1}{216} g_1^2 g_3^2 \text{LF}_{1,1,1,1,-1}[m_1, m_3, m_q^{i4}, m_q^{i2}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{1}{108} m_1 m_3 g_1^2 g_3^2 \text{LF}_{1,1,1,1,0}[m_1, m_3, m_q^{i4}, m_q^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{144} g_1^2 g_3^2 \text{LF}_{1,1,1,1,-1}[m_1, m_3, m_q^{i4}, m_q^{i3}] \delta_{i1i4} \delta_{i2i3} + \\
& \frac{1}{72} m_1 m_3 g_1^2 g_3^2 \text{LF}_{1,1,1,1,0}[m_1, m_3, m_q^{i4}, m_q^{i3}] \delta_{i1i4} \delta_{i2i3} + \\
& \frac{3}{16} g_2^2 g_3^2 \text{LF}_{1,1,1,1,-1}[m_2, m_3, m_q^{i4}, m_q^{i3}] \delta_{i1i4} \delta_{i2i3} + \\
& \frac{3}{8} m_2 m_3 g_2^2 g_3^2 \text{LF}_{1,1,1,1,0}[m_2, m_3, m_q^{i4}, m_q^{i3}] \delta_{i1i4} \delta_{i2i3} \bigg)
\end{aligned}$$