

$$\begin{aligned}
& \hbar \left(-\frac{1}{18} \frac{1}{m_s^2} (\overline{y_d}^{pi3} (9 y_d^{ri4} \overline{y_u}^{ri1} y_u^{pi2} + 4 g_3^2 s_\gamma^2 y_d^{pi4} \delta_{i1i2}) + 4 g_3^2 c_\gamma^2 \overline{y_u}^{pi1} y_u^{pi2} \delta_{i3i4}) + \right. \\
& \frac{2}{3} g_3^4 \text{LF}_{3,0}[m_3] \delta_{i1i2} \delta_{i3i4} + g_3^4 \text{LF}_{4,-1}[m_3] \delta_{i1i2} \delta_{i3i4} - \frac{16}{15} g_3^4 \text{LF}_{5,-2}[m_3] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{2}{9} \sum_p g_3^4 \text{LF}_{3,0}[m_d^p] \delta_{i1i2} \delta_{i3i4} - \frac{5}{12} \sum_p g_3^4 \text{LF}_{4,-1}[m_d^p] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{8}{45} \sum_p g_3^4 \text{LF}_{5,-2}[m_d^p] \delta_{i1i2} \delta_{i3i4} + \frac{4}{9} \sum_p g_3^4 \text{LF}_{3,0}[m_q^p] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{5}{6} \sum_p g_3^4 \text{LF}_{4,-1}[m_q^p] \delta_{i1i2} \delta_{i3i4} + \frac{16}{45} \sum_p g_3^4 \text{LF}_{5,-2}[m_q^p] \delta_{i1i2} \delta_{i3i4} + \frac{2}{9} \sum_p g_3^4 \text{LF}_{3,0}[m_u^p] \\
& \delta_{i1i2} \delta_{i3i4} - \frac{5}{12} \sum_p g_3^4 \text{LF}_{4,-1}[m_u^p] \delta_{i1i2} \delta_{i3i4} + \frac{8}{45} \sum_p g_3^4 \text{LF}_{5,-2}[m_u^p] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{3} (\overline{y_d}^{pi3} (3 y_d^{ri4} \overline{y_u}^{ri1} y_u^{pi2} (c_\gamma^2 - s_\gamma^2)^2 - 2 g_3^2 s_\gamma^2 y_d^{pi4} \delta_{i1i2}) - 2 g_3^2 c_\gamma^2 \overline{y_u}^{pi1} y_u^{pi2} \delta_{i3i4}) \\
& \text{LF}_{1,2}[m_\Phi] + 2 s_\gamma^2 c_\gamma^2 \overline{y_d}^{pi3} y_d^{ri4} \overline{y_u}^{ri1} y_u^{pi2} \text{LF}_{2,1}[m_\Phi] + \\
& \frac{1}{27} g_1^2 g_3^2 \text{LF}_{2,1,0}[m_1, m_d^{i4}] \delta_{i1i2} \delta_{i3i4} + \frac{1}{27} g_1^2 g_3^2 \text{LF}_{2,2,-1}[m_1, m_d^{i4}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{2}{27} g_1^2 g_3^2 \text{LF}_{3,1,-1}[m_1, m_d^{i4}] \delta_{i1i2} \delta_{i3i4} + \frac{1}{27} g_1^2 g_3^2 \text{LF}_{4,1,-2}[m_1, m_d^{i4}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{4}{27} g_1^2 g_3^2 \text{LF}_{2,1,0}[m_1, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} + \frac{4}{27} g_1^2 g_3^2 \text{LF}_{2,2,-1}[m_1, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{8}{27} g_1^2 g_3^2 \text{LF}_{3,1,-1}[m_1, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} + \frac{4}{27} g_1^2 g_3^2 \text{LF}_{4,1,-2}[m_1, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{1}{18} g_3^4 \text{LF}_{2,1,0}[m_3, m_d^{i4}] \delta_{i1i2} \delta_{i3i4} - \frac{1}{18} g_3^4 \text{LF}_{2,2,-1}[m_3, m_d^{i4}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{25}{18} g_3^4 \text{LF}_{3,1,-1}[m_3, m_d^{i4}] \delta_{i1i2} \delta_{i3i4} + \frac{4}{9} g_3^4 \text{LF}_{4,1,-2}[m_3, m_d^{i4}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{1}{18} g_3^4 \text{LF}_{2,1,0}[m_3, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} - \frac{1}{18} g_3^4 \text{LF}_{2,2,-1}[m_3, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{25}{18} g_3^4 \text{LF}_{3,1,-1}[m_3, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} + \frac{4}{9} g_3^4 \text{LF}_{4,1,-2}[m_3, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{2}{27} g_1^2 g_3^2 \text{LF}_{2,1,0}[m_d^{i4}, m_1] \delta_{i1i2} \delta_{i3i4} + \frac{1}{27} g_1^2 g_3^2 \text{LF}_{3,1,-1}[m_d^{i4}, m_1] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{9} g_3^4 \text{LF}_{2,1,0}[m_d^{i4}, m_3] \delta_{i1i2} \delta_{i3i4} - \frac{1}{18} g_3^4 \text{LF}_{3,1,-1}[m_d^{i4}, m_3] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{2}{3} g_3^2 (\overline{y_d}^{pi3} y_d^{pi4} \delta_{i1i2} + \overline{y_u}^{pi1} y_u^{pi2} \delta_{i3i4}) \text{LF}_{2,1,0}[m_q^p, \tilde{\mu}] + \\
& \frac{1}{3} g_3^2 (\overline{y_d}^{pi3} y_d^{pi4} \delta_{i1i2} + \overline{y_u}^{pi1} y_u^{pi2} \delta_{i3i4}) \text{LF}_{2,2,-1}[m_q^p, \tilde{\mu}] + \\
& \frac{1}{3} g_3^2 (\overline{y_d}^{pi3} y_d^{pi4} \delta_{i1i2} + \overline{y_u}^{pi1} y_u^{pi2} \delta_{i3i4}) \text{LF}_{3,1,-1}[m_q^p, \tilde{\mu}] - \\
& \frac{8}{27} g_1^2 g_3^2 \text{LF}_{2,1,0}[m_u^{i2}, m_1] \delta_{i1i2} \delta_{i3i4} + \frac{4}{27} g_1^2 g_3^2 \text{LF}_{3,1,-1}[m_u^{i2}, m_1] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{9} g_3^4 \text{LF}_{2,1,0}[m_u^{i2}, m_3] \delta_{i1i2} \delta_{i3i4} - \frac{1}{18} g_3^4 \text{LF}_{3,1,-1}[m_u^{i2}, m_3] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{3} g_3^2 (\overline{y_d}^{pi3} y_d^{pi4} \delta_{i1i2} + \overline{y_u}^{pi1} y_u^{pi2} \delta_{i3i4}) \text{LF}_{2,1,0}[\tilde{\mu}, m_q^p] - \\
& \frac{2}{3} g_3^2 (\overline{y_d}^{pi3} y_d^{pi4} \delta_{i1i2} + \overline{y_u}^{pi1} y_u^{pi2} \delta_{i3i4}) \text{LF}_{3,1,-1}[\tilde{\mu}, m_q^p] + \\
& \frac{1}{3} g_3^2 (\overline{y_d}^{pi3} y_d^{pi4} \delta_{i1i2} + \overline{y_u}^{pi1} y_u^{pi2} \delta_{i3i4}) \text{LF}_{4,1,-2}[\tilde{\mu}, m_q^p] + \\
& \frac{7}{6} g_3^4 \text{LF}_{2,1,1,-1}[m_3, m_d^{i4}, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} - \frac{2}{3} g_3^4 m_3^2 \text{LF}_{2,1,1,0}[m_3, m_d^{i4}, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \overline{y_d}^{pi3} y_d^{ri4} \overline{y_u}^{ri1} y_u^{pi2} \text{LF}_{2,1,1,-1}[\tilde{\mu}, m_q^p, m_q^r] - 2 \tilde{\mu}^2 \overline{y_d}^{pi3} y_d^{ri4} \overline{y_u}^{ri1} y_u^{pi2} \\
& \text{LF}_{2,1,1,0}[\tilde{\mu}, m_q^p, m_q^r] - \frac{4}{9} g_1^2 g_3^2 \text{LF}_{1,1,1,1,-1}[m_1, m_3, m_d^{i4}, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} - \\
& \left. \frac{8}{9} m_1 m_3 g_1^2 g_3^2 \text{LF}_{1,1,1,1,0}[m_1, m_3, m_d^{i4}, m_u^{i2}] \delta_{i1i2} \delta_{i3i4} \right)
\end{aligned}$$