

$$\begin{aligned}
& \hbar \left(\frac{1}{12} g_3 c_Y \frac{1}{m_s^2} y_d^{pi2} \left(3 s_Y^2 \overline{y_d^{pr}} y_d^{i1r} + \overline{y_u^{pr}} y_u^{i1r} \left(c_Y^2 - 3 s_Y^2 \right) \right) - \frac{1}{2} g_3 c_Y s_Y^2 y_d^{pi2} \overline{y_u^{pr}} y_u^{i1r} \right. \\
& \quad LF_{1,2} [m_\Phi] + \frac{1}{18} g_3 c_Y g_1^2 y_d^{i1i2} LF_{2,1,0} [m_1, m_d^{i2}] - \frac{1}{9} g_3 c_Y g_1^2 y_d^{i1i2} LF_{3,1,-1} [m_1, m_d^{i2}] + \\
& \quad \frac{1}{18} g_3 c_Y g_1^2 y_d^{i1i2} LF_{4,1,-2} [m_1, m_d^{i2}] + \frac{1}{72} g_3 c_Y g_1^2 y_d^{i1i2} LF_{2,1,0} [m_1, m_q^{i1}] - \\
& \quad \frac{1}{36} g_3 c_Y g_1^2 y_d^{i1i2} LF_{3,1,-1} [m_1, m_q^{i1}] + \frac{1}{72} g_3 c_Y g_1^2 y_d^{i1i2} LF_{4,1,-2} [m_1, m_q^{i1}] + \\
& \quad \frac{3}{8} g_3 c_Y g_2^2 y_d^{i1i2} LF_{2,1,0} [m_2, m_q^{i1}] - \frac{3}{4} g_3 c_Y g_2^2 y_d^{i1i2} LF_{3,1,-1} [m_2, m_q^{i1}] + \\
& \quad \frac{3}{8} g_3 c_Y g_2^2 y_d^{i1i2} LF_{4,1,-2} [m_2, m_q^{i1}] - \frac{1}{12} c_Y g_3^3 y_d^{i1i2} LF_{2,1,0} [m_3, m_d^{i2}] - \\
& \quad \frac{7}{12} c_Y g_3^3 y_d^{i1i2} LF_{3,1,-1} [m_3, m_d^{i2}] + \frac{2}{3} c_Y g_3^3 y_d^{i1i2} LF_{4,1,-2} [m_3, m_d^{i2}] - \\
& \quad \frac{1}{12} c_Y g_3^3 y_d^{i1i2} LF_{2,1,0} [m_3, m_q^{i1}] - \frac{7}{12} c_Y g_3^3 y_d^{i1i2} LF_{3,1,-1} [m_3, m_q^{i1}] + \\
& \quad \frac{2}{3} c_Y g_3^3 y_d^{i1i2} LF_{4,1,-2} [m_3, m_q^{i1}] + \frac{1}{4} g_3 c_Y \overline{y_d^{pr}} y_d^{pi2} y_d^{i1r} LF_{2,1,0} [\tilde{\mu}, m_d^r] - \\
& \quad \frac{1}{2} g_3 c_Y \overline{y_d^{pr}} y_d^{pi2} y_d^{i1r} LF_{3,1,-1} [\tilde{\mu}, m_d^r] + \frac{1}{4} g_3 c_Y \overline{y_d^{pr}} y_d^{pi2} y_d^{i1r} LF_{4,1,-2} [\tilde{\mu}, m_d^r] + \\
& \quad \frac{1}{2} g_3 c_Y \overline{y_d^{pr}} y_d^{pi2} y_d^{i1r} LF_{2,1,0} [\tilde{\mu}, m_q^p] - g_3 c_Y \overline{y_d^{pr}} y_d^{pi2} y_d^{i1r} LF_{3,1,-1} [\tilde{\mu}, m_q^p] + \\
& \quad \frac{1}{2} g_3 c_Y \overline{y_d^{pr}} y_d^{pi2} y_d^{i1r} LF_{4,1,-2} [\tilde{\mu}, m_q^p] + \frac{1}{4} g_3 c_Y y_d^{pi2} \overline{y_u^{pr}} y_u^{i1r} LF_{2,1,0} [\tilde{\mu}, m_u^r] - \\
& \quad \frac{1}{2} g_3 c_Y y_d^{pi2} \overline{y_u^{pr}} y_u^{i1r} LF_{3,1,-1} [\tilde{\mu}, m_u^r] + \frac{1}{4} g_3 c_Y y_d^{pi2} \overline{y_u^{pr}} y_u^{i1r} LF_{4,1,-2} [\tilde{\mu}, m_u^r] + \\
& \quad \frac{1}{18} g_3 m_1 g_1^2 (c_Y a_d^{i1i2} - s_Y \tilde{\mu} y_d^{i1i2}) LF_{2,1,1,0} [m_1, m_d^{i2}, m_q^{i1}] + \\
& \quad \frac{1}{18} g_3 m_1 g_1^2 (-c_Y a_d^{i1i2} + s_Y \tilde{\mu} y_d^{i1i2}) LF_{3,1,1,-1} [m_1, m_d^{i2}, m_q^{i1}] + \\
& \quad \frac{1}{6} g_3 c_Y g_1^2 y_d^{i1i2} LF_{1,1,1,0} [m_1, m_d^{i2}, \tilde{\mu}] - \frac{1}{3} g_3 c_Y g_1^2 y_d^{i1i2} LF_{2,1,1,-1} [m_1, m_d^{i2}, \tilde{\mu}] - \\
& \quad \frac{1}{6} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{2,1,1,0} [m_1, m_d^{i2}, \tilde{\mu}] + \frac{1}{6} g_3 c_Y g_1^2 y_d^{i1i2} LF_{3,1,1,-2} [m_1, m_d^{i2}, \tilde{\mu}] + \\
& \quad \frac{1}{6} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{3,1,1,-1} [m_1, m_d^{i2}, \tilde{\mu}] + \frac{1}{12} g_3 c_Y g_1^2 y_d^{i1i2} LF_{1,1,1,0} [m_1, m_q^{i1}, \tilde{\mu}] - \\
& \quad \frac{1}{6} g_3 c_Y g_1^2 y_d^{i1i2} LF_{2,1,1,-1} [m_1, m_q^{i1}, \tilde{\mu}] - \frac{1}{12} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{2,1,1,0} [m_1, m_q^{i1}, \tilde{\mu}] + \\
& \quad \frac{1}{12} g_3 c_Y g_1^2 y_d^{i1i2} LF_{3,1,1,-2} [m_1, m_q^{i1}, \tilde{\mu}] + \frac{1}{12} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{3,1,1,-1} [m_1, m_q^{i1}, \tilde{\mu}] + \\
& \quad \frac{1}{6} g_3 c_Y g_1^2 y_d^{i1i2} LF_{2,2,1,-2} [m_1, \tilde{\mu}, m_d^{i2}] + \frac{1}{6} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{2,2,1,-1} [m_1, \tilde{\mu}, m_d^{i2}] + \\
& \quad \frac{1}{12} g_3 c_Y g_1^2 y_d^{i1i2} LF_{2,2,1,-2} [m_1, \tilde{\mu}, m_q^{i1}] + \frac{1}{12} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{2,2,1,-1} [m_1, \tilde{\mu}, m_q^{i1}] + \\
& \quad \frac{3}{4} g_3 c_Y g_2^2 y_d^{i1i2} LF_{1,1,1,0} [m_2, m_q^{i1}, \tilde{\mu}] - \frac{3}{2} g_3 c_Y g_2^2 y_d^{i1i2} LF_{2,1,1,-1} [m_2, m_q^{i1}, \tilde{\mu}] - \\
& \quad \frac{3}{4} g_3 m_2 s_Y \tilde{\mu} g_2^2 y_d^{i1i2} LF_{2,1,1,0} [m_2, m_q^{i1}, \tilde{\mu}] + \frac{3}{4} g_3 c_Y g_2^2 y_d^{i1i2} LF_{3,1,1,-2} [m_2, m_q^{i1}, \tilde{\mu}] + \\
& \quad \frac{3}{4} g_3 m_2 s_Y \tilde{\mu} g_2^2 y_d^{i1i2} LF_{3,1,1,-1} [m_2, m_q^{i1}, \tilde{\mu}] + \frac{3}{4} g_3 c_Y g_2^2 y_d^{i1i2} LF_{2,2,1,-2} [m_2, \tilde{\mu}, m_q^{i1}] + \\
& \quad \frac{3}{4} g_3 m_2 s_Y \tilde{\mu} g_2^2 y_d^{i1i2} LF_{2,2,1,-1} [m_2, \tilde{\mu}, m_q^{i1}] + \frac{1}{6} m_3 g_3^3 (c_Y a_d^{i1i2} - s_Y \tilde{\mu} y_d^{i1i2}) \\
& \quad LF_{2,1,1,0} [m_3, m_d^{i2}, m_q^{i1}] + \frac{4}{3} m_3 g_3^3 (c_Y a_d^{i1i2} - s_Y \tilde{\mu} y_d^{i1i2}) LF_{3,1,1,-1} [m_3, m_d^{i2}, m_q^{i1}] - \\
& \quad \frac{1}{3} g_3 c_Y g_1^2 y_d^{i1i2} LF_{2,1,1,-1} [\tilde{\mu}, m_1, m_d^{i2}] - \frac{1}{6} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{2,1,1,0} [\tilde{\mu}, m_1, m_d^{i2}] + \\
& \quad \frac{1}{6} g_3 c_Y g_1^2 y_d^{i1i2} LF_{3,1,1,-2} [\tilde{\mu}, m_1, m_d^{i2}] + \frac{1}{6} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{3,1,1,-1} [\tilde{\mu}, m_1, m_d^{i2}] - \\
& \quad \frac{1}{6} g_3 c_Y g_1^2 y_d^{i1i2} LF_{2,1,1,-1} [\tilde{\mu}, m_1, m_q^{i1}] - \frac{1}{12} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{2,1,1,0} [\tilde{\mu}, m_1, m_q^{i1}] + \\
& \quad \frac{1}{12} g_3 c_Y g_1^2 y_d^{i1i2} LF_{3,1,1,-2} [\tilde{\mu}, m_1, m_q^{i1}] + \frac{1}{12} g_3 m_1 s_Y \tilde{\mu} g_1^2 y_d^{i1i2} LF_{3,1,1,-1} [\tilde{\mu}, m_1, m_q^{i1}] - \\
& \quad \frac{3}{2} g_3 c_Y g_2^2 y_d^{i1i2} LF_{2,1,1,-1} [\tilde{\mu}, m_2, m_q^{i1}] - \frac{3}{4} g_3 m_2 s_Y \tilde{\mu} g_2^2 y_d^{i1i2} LF_{2,1,1,0} [\tilde{\mu}, m_2, m_q^{i1}] + \\
& \quad \frac{3}{4} g_3 c_Y g_2^2 y_d^{i1i2} LF_{3,1,1,-2} [\tilde{\mu}, m_2, m_q^{i1}] + \frac{3}{4} g_3 m_2 s_Y \tilde{\mu} g_2^2 y_d^{i1i2} LF_{3,1,1,-1} [\tilde{\mu}, m_2, m_q^{i1}] + \\
& \quad \frac{1}{2} g_3 \tilde{\mu} y_d^{pi2} y_u^{i1r} (s_Y \overline{a_u^{pr}} - \tilde{\mu} c_Y \overline{y_u^{pr}}) LF_{2,1,1,0} [\tilde{\mu}, m_q^p, m_u^r] + \\
& \quad \frac{1}{2} g_3 \tilde{\mu} y_d^{pi2} y_u^{i1r} (-s_Y \overline{a_u^{pr}} + \tilde{\mu} c_Y \overline{y_u^{pr}}) LF_{3,1,1,-1} [\tilde{\mu}, m_q^p, m_u^r] \Big)
\end{aligned}$$