

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