

$$\begin{aligned} & \hbar \left(-\frac{1}{72} \frac{1}{m_e^2} (c_Y^2 (-9 \bar{y}_d^{\text{pr}} y_d^{\text{ir}} \bar{y}_u^{\text{ir}2i3} y_u^{\text{pi}4} (-1 + s_Y^2) + y_u^{\text{ii}4} (4 \bar{y}_u^{\text{ir}2i3} (23 g_1^2 + 27 g_2^2 + 6 g_3^2) + \right. \\ & \quad \left. 9 \bar{y}_u^{\text{ri}3} (-\bar{y}_d^{\text{ir}2p} y_d^{\text{rp}} (-1 + s_Y^2) + 3 \bar{y}_u^{\text{ir}2p} y_u^{\text{rp}} (1 + c_Y^2))) + \right. \\ & \quad \left. 27 \bar{y}_u^{\text{pr}} \bar{y}_u^{\text{ir}2i3} (y_u^{\text{pi}4} y_u^{\text{ir}} (1 + c_Y^2) + 8 s_Y^2 y_u^{\text{pr}} y_u^{\text{ii}4}) + 16 g_3^2 \bar{y}_u^{\text{pi}3} y_u^{\text{pi}4} \delta_{i1i2}) + \right. \\ & \quad \left. 8 g_3^2 (s_Y^2 \bar{y}_d^{\text{ir}2p} y_d^{\text{ir}1p} + c_Y^2 \bar{y}_u^{\text{ir}2p} y_u^{\text{ir}1p}) \delta_{i3i4}) + \frac{2}{3} g_3^4 \text{LF}_{3,0}[\text{m}_3] \delta_{i1i2} \delta_{i3i4} + \right. \\ & \quad g_3^4 \text{LF}_{4,-1}[\text{m}_3] \delta_{i1i2} \delta_{i3i4} - \frac{16}{15} g_3^4 \text{LF}_{5,-2}[\text{m}_3] \delta_{i1i2} \delta_{i3i4} - \\ & \quad \frac{1}{2} \sum_{\text{p}} c_Y g_1^2 \frac{1}{m_e^4} \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} (c_{2Y} c_Y - 2 s_{2Y} s_Y) \text{LF}_{1,0}[\text{m}_d^{\text{p}}] + \\ & \quad \frac{2}{9} \sum_{\text{p}} g_3^4 \text{LF}_{3,0}[\text{m}_d^{\text{p}}] \delta_{i1i2} \delta_{i3i4} - \frac{5}{12} \sum_{\text{p}} g_3^4 \text{LF}_{4,-1}[\text{m}_d^{\text{p}}] \delta_{i1i2} \delta_{i3i4} + \\ & \quad - \frac{8}{45} \sum_{\text{p}} g_3^4 \text{LF}_{5,-2}[\text{m}_d^{\text{p}}] \delta_{i1i2} \delta_{i3i4} - \\ & \quad 3 s_Y c_Y \frac{1}{m_e^4} \bar{y}_d^{\text{pr}} y_d^{\text{pr}} \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} (s_{2Y} + s_Y c_Y) \text{LF}_{1,0}[\text{m}_d^{\text{r}}] - \\ & \quad \frac{1}{2} \sum_{\text{p}} c_Y g_1^2 \frac{1}{m_e^4} \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} (c_{2Y} c_Y - 2 s_{2Y} s_Y) \text{LF}_{1,0}[\text{m}_e^{\text{p}}] - \\ & \quad s_Y c_Y \frac{1}{m_e^4} \bar{y}_e^{\text{pr}} y_e^{\text{pr}} \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} (s_{2Y} + s_Y c_Y) \text{LF}_{1,0}[\text{m}_e^{\text{r}}] + \\ & \quad \frac{1}{2} c_Y \frac{1}{m_e^4} \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} (-2 s_Y \bar{y}_e^{\text{pr}} y_e^{\text{pr}} (s_{2Y} + s_Y c_Y) + \sum_{\text{p}} g_1^2 (c_{2Y} c_Y - 2 s_{2Y} s_Y)) \text{LF}_{1,0}[\text{m}_l^{\text{p}}] - \\ & \quad \frac{1}{2} c_Y \frac{1}{m_e^4} \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \\ & \quad (6 s_Y \bar{y}_d^{\text{pr}} y_d^{\text{pr}} (s_{2Y} + s_Y c_Y) + 6 \bar{y}_u^{\text{pr}} y_u^{\text{pr}} (c_Y^3 - s_{2Y} s_Y) + \sum_{\text{p}} g_1^2 (c_{2Y} c_Y - 2 s_{2Y} s_Y)) \\ & \quad \text{LF}_{1,0}[\text{m}_p] + \frac{4}{9} \sum_{\text{p}} g_3^4 \text{LF}_{3,0}[\text{m}_p] \delta_{i1i2} \delta_{i3i4} - \\ & \quad \frac{5}{6} \sum_{\text{p}} g_3^4 \text{LF}_{4,-1}[\text{m}_p] \delta_{i1i2} \delta_{i3i4} + \frac{16}{45} \sum_{\text{p}} g_3^4 \text{LF}_{5,-2}[\text{m}_p] \delta_{i1i2} \delta_{i3i4} + \\ & \quad \sum_{\text{p}} c_Y g_1^2 \frac{1}{m_e^4} \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} (c_{2Y} c_Y - 2 s_{2Y} s_Y) \text{LF}_{1,0}[\text{m}_u^{\text{p}}] + \frac{2}{9} \sum_{\text{p}} g_3^4 \text{LF}_{3,0}[\text{m}_u^{\text{p}}] \delta_{i1i2} \delta_{i3i4} - \\ & \quad \frac{5}{12} \sum_{\text{p}} g_3^4 \text{LF}_{4,-1}[\text{m}_u^{\text{p}}] \delta_{i1i2} \delta_{i3i4} + \frac{8}{45} \sum_{\text{p}} g_3^4 \text{LF}_{5,-2}[\text{m}_u^{\text{p}}] \delta_{i1i2} \delta_{i3i4} - \\ & \quad 3 c_Y \frac{1}{m_e^4} \bar{y}_u^{\text{pr}} \bar{y}_u^{\text{ir}2i3} y_u^{\text{pr}} y_u^{\text{ii}4} (c_Y^3 - s_{2Y} s_Y) \text{LF}_{1,0}[\text{m}_u^{\text{r}}] + \\ & \quad \frac{1}{4} c_Y \frac{1}{m_e^4} \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} (c_Y (g_1^2 (1 - 3 c_{2Y}^2) - 3 g_2^2 (-1 + c_{2Y}^2)) + 3 s_{4Y} s_Y (g_1^2 + g_2^2)) \\ & \quad \text{LF}_{1,0}[\text{m}_e] + \frac{1}{4} \frac{1}{m_e^2} c_Y^2 (3 \bar{y}_u^{\text{ir}2i3} y_u^{\text{pi}4} (-s_Y^2 \bar{y}_d^{\text{pr}} y_d^{\text{ir}} + c_Y^2 \bar{y}_u^{\text{pr}} y_u^{\text{ir}}) - \\ & \quad y_u^{\text{ii}4} (2 \bar{y}_u^{\text{ir}2i3} (g_1^2 + 3 g_2^2) + 3 \bar{y}_u^{\text{ri}3} (s_Y^2 \bar{y}_d^{\text{ir}2p} y_d^{\text{rp}} - c_Y^2 \bar{y}_u^{\text{ir}2p} y_u^{\text{rp}}))) \text{LF}_{1,1}[\text{m}_e] + \\ & \quad \frac{1}{12} (c_Y^2 (6 s_Y^2 \bar{y}_d^{\text{pr}} y_d^{\text{ir}} \bar{y}_u^{\text{ir}2i3} y_u^{\text{pi}4} + 3 y_u^{\text{ii}4} (\bar{y}_u^{\text{ir}2i3} (g_1^2 + 3 g_2^2) + 2 s_Y^2 \bar{y}_d^{\text{ir}2p} y_d^{\text{rp}} \bar{y}_u^{\text{ri}3}) - \\ & \quad 8 g_3^2 \bar{y}_u^{\text{pi}3} y_u^{\text{pi}4} \delta_{i1i2}) - 4 g_3^2 (s_Y^2 \bar{y}_d^{\text{ir}2p} y_d^{\text{ir}1p} + c_Y^2 \bar{y}_u^{\text{ir}2p} y_u^{\text{ir}1p}) \delta_{i3i4}) \text{LF}_{1,2}[\text{m}_e] + \\ & \quad \frac{1}{36} g_1^2 \frac{1}{m_e^2} c_Y^2 \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \text{LF}_{1,1,0}[\text{m}_1, \text{m}_q^{\text{ii}1}] - \frac{1}{72} g_1^2 \frac{1}{m_e^2} c_Y^2 \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \text{LF}_{2,1,-1}[\text{m}_1, \text{m}_q^{\text{ii}1}] + \\ & \quad - \frac{1}{36} g_1^2 \frac{1}{m_e^2} c_Y^2 \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \text{LF}_{1,1,0}[\text{m}_1, \text{m}_q^{\text{ii}2}] - \\ & \quad \frac{1}{72} g_1^2 \frac{1}{m_e^2} c_Y^2 \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \text{LF}_{2,1,-1}[\text{m}_1, \text{m}_q^{\text{ii}2}] + \frac{1}{108} g_1^2 g_3^2 \text{LF}_{2,1,0}[\text{m}_1, \text{m}_q^{\text{ii}2}] \delta_{i1i2} \delta_{i3i4} + \\ & \quad - \frac{1}{108} g_1^2 g_3^2 \text{LF}_{2,2,-1}[\text{m}_1, \text{m}_q^{\text{ii}2}] \delta_{i1i2} \delta_{i3i4} - \frac{1}{54} g_1^2 g_3^2 \text{LF}_{3,1,-1}[\text{m}_1, \text{m}_q^{\text{ii}2}] \delta_{i1i2} \delta_{i3i4} + \\ & \quad - \frac{1}{108} g_1^2 g_3^2 \text{LF}_{4,1,-2}[\text{m}_1, \text{m}_q^{\text{ii}2}] \delta_{i1i2} \delta_{i3i4} + \frac{4}{9} g_1^2 \frac{1}{m_e^2} c_Y^2 \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \text{LF}_{1,1,0}[\text{m}_1, \text{m}_u^{\text{ii}3}] - \\ & \quad \frac{2}{9} g_1^2 \frac{1}{m_e^2} c_Y^2 \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \text{LF}_{2,1,-1}[\text{m}_1, \text{m}_u^{\text{ii}3}] + \frac{4}{9} g_1^2 \frac{1}{m_e^2} c_Y^2 \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \text{LF}_{1,1,0}[\text{m}_1, \text{m}_u^{\text{ii}4}] - \\ & \quad \frac{2}{9} g_1^2 \frac{1}{m_e^2} c_Y^2 \bar{y}_u^{\text{ir}2i3} y_u^{\text{ii}4} \text{LF}_{2,1,-1}[\text{m}_1, \text{m}_u^{\text{ii}4}] + \frac{27}{47} g_1^2 g_3^2 \text{LF}_{2,1,0}[\text{m}_1, \text{m}_u^{\text{ii}4}] \delta_{i1i2} \delta_{i3i4} + \\ & \quad \frac{27}{47} g_1^2 g_3^2 \text{LF}_{2,2,-1}[\text{m}_1, \text{m}_u^{\text{ii}4}] \delta_{i1i2} \delta_{i3i4} - \frac{87}{27} g_1^2 g_3^2 \text{LF}_{3,1,-1}[\text{m}_1, \text{m}_u^{\text{ii}4}] \delta_{i1i2} \delta_{i3i4} + \\ & \quad \frac{47}{27} g_1^2 g_3^2 \text{LF}_{4,1,-2}[\text{m}_1, \text{m}_u^{\text{ii}4}] \delta_{i1i2} \delta_{i3i4} + g_1^2 \frac{1}{m_e^4} c_Y^2 \bar{y}_u^$$