

$$\begin{aligned} & \frac{\hbar}{2} \frac{B^{\mu\nu 2} - \frac{1}{4} \frac{B^{\mu\nu 2}}{g_Y^2} - \frac{1}{4} \frac{B^{\mu\nu 2}}{g_S^2} - \frac{1}{4} \frac{G^{\mu\nu A^2}}{g_S^2} - \frac{1}{4} \frac{W^{\mu\nu I^2}}{g_L^2} - \frac{1}{12} \hbar B^{\mu\nu 2} \text{Log} \left[ \frac{\mu^2}{M_\phi^2} \right] + D_\mu \bar{H}_i D_\mu H^i + C_\mu{}^2 \bar{H}_i H^i + \\ & i \left( \bar{d}_a^r \cdot \gamma_\mu P_R \cdot D_\mu d^{ar} \right) + i \left( \bar{e}^r \cdot \gamma_\mu P_R \cdot D_\mu e^r \right) + i \left( \bar{l}_i^r \cdot \gamma_\mu P_L \cdot D_\mu l^{ir} \right) + i \left( \bar{q}_{a1}^r \cdot \gamma_\mu P_L \cdot D_\mu q^{a1r} \right) + \\ & i \left( \bar{u}_a^r \cdot \gamma_\mu P_R \cdot D_\mu u^{ar} \right) - \frac{1}{2} \lambda \bar{H}_i \bar{H}_j H^i H^j + \frac{1}{2} \hbar \frac{1}{\lambda_{H_X}} \lambda_{H_X}^2 \bar{H}_i \bar{H}_j H^i H^j + \frac{1}{2} \hbar \lambda_{H_X} \lambda_{H_X}^2 \bar{H}_i \bar{H}_j H^i H^j \text{Log} \left[ \frac{\mu^2}{M_\phi^2} \right] - \\ & \overline{Y_d}^{Pr} \bar{H}_i \left( \bar{d}_a^r \cdot P_L \cdot q^{a1p} \right) - \overline{Y_e}^{Pr} \bar{H}_i \left( \bar{e}^r \cdot P_L \cdot l^{ip} \right) - \frac{1}{8} \hbar \overline{Y_e}^{Ps} \overline{\lambda_{\psi X}}^{\text{st}} \lambda_{\psi X}{}^{rt} \bar{H}_i \left( \bar{e}^r \cdot P_L \cdot l^{ip} \right) + \\ & \frac{1}{4} \hbar \frac{1}{\epsilon} \overline{Y_e}^{Ps} \overline{\lambda_{\psi X}}^{\text{st}} \lambda_{\psi X}{}^{rt} \bar{H}_i \left( \bar{e}^r \cdot P_L \cdot l^{ip} \right) + \frac{1}{2} \hbar \overline{Y_e}^{Ps} \overline{\lambda_{\psi X}}^{\text{st}} \lambda_{\psi X}{}^{rt} \text{LF}_{1,1,0} [M_\phi, M_X^t] \bar{H}_i \left( \bar{e}^r \cdot P_L \cdot l^{ip} \right) - \\ & \frac{1}{4} \hbar \overline{Y_e}^{Ps} \overline{\lambda_{\psi X}}^{\text{st}} \lambda_{\psi X}{}^{rt} \text{LF}_{2,1,-1} [M_X^t, M_\phi] \bar{H}_i \left( \bar{e}^r \cdot P_L \cdot l^{ip} \right) - Y_e{}^{rP} H^i \left( \bar{l}_i^r \cdot P_R \cdot e^P \right) - \\ & \frac{1}{8} \hbar Y_e{}^{rt} \overline{\lambda_{\psi X}}^{\text{ps}} \lambda_{\psi X}{}^{ts} H^i \left( \bar{l}_i^r \cdot P_R \cdot e^P \right) + \frac{1}{4} \hbar \frac{1}{\epsilon} Y_e{}^{rt} \overline{\lambda_{\psi X}}^{\text{ps}} \lambda_{\psi X}{}^{ts} H^i \left( \bar{l}_i^r \cdot P_R \cdot e^P \right) + \\ & \frac{1}{2} \hbar Y_e{}^{rt} \overline{\lambda_{\psi X}}^{\text{ps}} \lambda_{\psi X}{}^{ts} \text{LF}_{1,1,0} [M_\phi, M_X^s] H^i \left( \bar{l}_i^r \cdot P_R \cdot e^P \right) - \\ & \frac{1}{4} \hbar Y_e{}^{rt} \overline{\lambda_{\psi X}}^{\text{ps}} \lambda_{\psi X}{}^{ts} \text{LF}_{2,1,-1} [M_X^s, M_\phi] H^i \left( \bar{l}_i^r \cdot P_R \cdot e^P \right) - Y_d{}^{rP} H^i \left( \bar{q}_{a1}^r \cdot P_R \cdot d^{ap} \right) - \\ Y_u{}^{rP} \bar{H}_i \left( \bar{q}_{aj}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{ji} - \overline{Y_u}^{Pr} H_j \left( \bar{u}_a^r \cdot P_L \cdot q^{a1p} \right) \bar{\epsilon}_{ij} - \frac{1}{120} \hbar C_H{}^2 g_Y^4 \frac{1}{M_\phi^2} \bar{H}_i \bar{H}_j H^i H^j - \\ & \frac{1}{6} \hbar C_H{}^2 \frac{1}{M_\phi^2} \lambda_{H_X}^2 \bar{H}_i \bar{H}_j H^i H^j + \frac{1}{120} \hbar \lambda g_Y^4 \frac{1}{M_\phi^2} \bar{H}_i \bar{H}_j \bar{H}_K H^i H^j H^K + \\ & \frac{1}{6} \hbar \lambda \frac{1}{M_\phi^2} \lambda_{H_X}^2 \bar{H}_i \bar{H}_j \bar{H}_K H^i H^j H^K + \frac{1}{6} \hbar \frac{1}{M_\phi^2} \lambda_{H_X}^3 \bar{H}_i \bar{H}_j \bar{H}_K H^i H^j H^K - \frac{1}{60} \hbar g_Y^4 \frac{1}{M_\phi^2} D_\mu \bar{H}_i \bar{H}_j H^i D_\mu H^j - \\ & \frac{1}{120} \hbar g_Y^4 \frac{1}{M_\phi^2} \bar{H}_i D_\mu \bar{H}_j H^i D_\mu H^j - \frac{1}{6} \hbar \frac{1}{M_\phi^2} \lambda_{H_X}^2 \bar{H}_i D_\mu \bar{H}_j H^i D_\mu H^j - \frac{1}{12} \hbar \lambda_{H_X} \frac{1}{M_\phi^2} \bar{H}_i H^i B^{\mu\nu 2} + \\ & \frac{1}{240} \hbar g_Y^4 \frac{1}{M_\phi^2} \overline{Y_d}^{Pr} \bar{H}_i \bar{H}_j H^i \left( \bar{d}_a^r \cdot P_L \cdot q^{ajp} \right) + \frac{1}{12} \hbar \frac{1}{M_\phi^2} \lambda_{H_X}^2 \overline{Y_d}^{Pr} \bar{H}_i \bar{H}_j H^i \left( \bar{d}_a^r \cdot P_L \cdot q^{ajp} \right) + \\ & \frac{1}{240} \hbar g_Y^4 \frac{1}{M_\phi^2} \overline{Y_e}^{Pr} \bar{H}_i \bar{H}_j H^i \left( \bar{e}^r \cdot P_L \cdot l^{jp} \right) + \frac{1}{12} \hbar \frac{1}{M_\phi^2} \lambda_{H_X}^2 \overline{Y_e}^{Pr} \bar{H}_i \bar{H}_j H^i \left( \bar{e}^r \cdot P_L \cdot l^{jp} \right) - \\ & \frac{1}{2} \hbar \lambda_{H_X} \overline{Y_e}^{Ps} \overline{\lambda_{\psi X}}^{\text{st}} \lambda_{\psi X}{}^{rt} \text{LF}_{2,1,0} [M_\phi, M_X^t] \bar{H}_i \bar{H}_j H^i \left( \bar{e}^r \cdot P_L \cdot l^{jp} \right) + \\ & \frac{1}{4} \hbar \lambda_{H_X} \overline{Y_e}^{Ps} \overline{\lambda_{\psi X}}^{\text{st}} \lambda_{\psi X}{}^{rt} \text{LF}_{2,2,-1} [M_\phi, M_X^t] \bar{H}_i \bar{H}_j H^i \left( \bar{e}^r \cdot P_L \cdot l^{jp} \right) - \\ & \frac{1}{2} \hbar \overline{Y_e}^{Ps} \overline{Y_e}^{tr} Y_e{}^{tv} \overline{\lambda_{\psi X}}^{\text{su}} \lambda_{\psi X}{}^{vu} \text{LF}_{2,1,0} [M_X^u, M_\phi] \bar{H}_i \bar{H}_j H^i \left( \bar{e}^r \cdot P_L \cdot l^{jp} \right) + \\ & \hbar \overline{Y_e}^{Ps} \overline{Y_e}^{tr} Y_e{}^{tv} \overline{\lambda_{\psi X}}^{\text{su}} \lambda_{\psi X}{}^{vu} \text{LF}_{3,1,-1} [M_X^u, M_\phi] \bar{H}_i \bar{H}_j H^i \left( \bar{e}^r \cdot P_L \cdot l^{jp} \right) - \\ & \frac{1}{2} \hbar \overline{Y_e}^{Ps} \overline{Y_e}^{tr} Y_e{}^{tv} \overline{\lambda_{\psi X}}^{\text{su}} \lambda_{\psi X}{}^{vu} \text{LF}_{4,1,-2} [M_X^u, M_\phi] \bar{H}_i \bar{H}_j H^i \left( \bar{e}^r \cdot P_L \cdot l^{jp} \right) + \\ & \frac{1}{240} \hbar g_Y^4 \frac{1}{M_\phi^2} Y_e{}^{rP} \bar{H}_i H^i H^j \left( \bar{l}_j^r \cdot P_R \cdot e^P \right) + \frac{1}{12} \hbar \frac{1}{M_\phi^2} \lambda_{H_X}^2 Y_e{}^{rP} \bar{H}_i H^i H^j \left( \bar{l}_j^r \cdot P_R \cdot e^P \right) - \\ & \frac{1}{2} \hbar \lambda_{H_X} Y_e{}^{rt} \overline{\lambda_{\psi X}}^{\text{ps}} \lambda_{\psi X}{}^{ts} \text{LF}_{2,1,0} [M_\phi, M_X^s] \bar{H}_i H^i H^j \left( \bar{l}_j^r \cdot P_R \cdot e^P \right) + \\ & \frac{1}{4} \hbar \lambda_{H_X} Y_e{}^{rt} \overline{\lambda_{\psi X}}^{\text{ps}} \lambda_{\psi X}{}^{ts} \text{LF}_{2,2,-1} [M_\phi, M_X^s] \bar{H}_i H^i H^j \left( \bar{l}_j^r \cdot P_R \cdot e^P \right) - \\ & \frac{1}{2} \hbar \overline{Y_e}^{\text{st}} Y_e{}^{rv} Y_e{}^{sp} \overline{\lambda_{\psi X}}^{\text{tu}} \lambda_{\psi X}{}^{vu} \text{LF}_{2,1,0} [M_X^u, M_\phi] \bar{H}_i H^i H^j \left( \bar{l}_j^r \cdot P_R \cdot e^P \right) + \\ & \hbar \overline{Y_e}^{\text{st}} Y_e{}^{rv} Y_e{}^{sp} \overline{\lambda_{\psi X}}^{\text{tu}} \lambda_{\psi X}{}^{vu} \text{LF}_{3,1,-1} [M_X^u, M_\phi] \bar{H}_i H^i H^j \left( \bar{l}_j^r \cdot P_R \cdot e^P \right) - \\ & \frac{1}{2} \hbar \overline{Y_e}^{\text{st}} Y_e{}^{rv} Y_e{}^{sp} \overline{\lambda_{\psi X}}^{\text{tu}} \lambda_{\psi X}{}^{vu} \text{LF}_{4,1,-2} [M_X^u, M_\phi] \bar{H}_i H^i H^j \left( \bar{l}_j^r \cdot P_R \cdot e^P \right) + \\ & \frac{1}{240} \hbar g_Y^4 \frac{1}{M_\phi^2} Y_d{}^{rP} \bar{H}_i H^i H^j \left( \bar{q}_{aj}^r \cdot P_R \cdot d^{ap} \right) + \frac{1}{12} \hbar \frac{1}{M_\phi^2} \lambda_{H_X}^2 Y_d{}^{rP} \bar{H}_i H^i H^j \left( \bar{q}_{aj}^r \cdot P_R \cdot d^{ap} \right) + \\ & \frac{1}{240} \hbar g_Y^4 \frac{1}{M_\phi^2} Y_u{}^{rP} \bar{H}_i \bar{H}_j H^i \left( \bar{q}_{ak}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{kj} + \frac{1}{12} \hbar \frac{1}{M_\phi^2} \lambda_{H_X}^2 Y_u{}^{rP} \bar{H}_i \bar{H}_j H^i \left( \bar{q}_{ak}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{kj} + \\ & \frac{1}{240} \hbar g_Y^4 \frac{1}{M_\phi^2} \overline{Y_u}^{Pr} \bar{H}_i H^i H^K \left( \bar{u}_a^r \cdot P_L \cdot q^{ajp} \right) \bar{\epsilon}_{jk} + \frac{1}{12} \hbar \frac{1}{M_\phi^2} \lambda_{H_X}^2 \overline{Y_u}^{Pr} \bar{H}_i H^i H^K \left( \bar{u}_a^r \cdot P$$