

$$\begin{aligned}
& \frac{1}{6} \hbar \epsilon^{-} B^{\mu\nu 2} - \frac{1}{4} \frac{1}{g_Y^2} B^{\mu\nu 2} - \frac{1}{6} \hbar \epsilon^{-} G^{\mu\nu A 2} - \frac{1}{4} \frac{1}{g_S^2} G^{\mu\nu A 2} - \frac{1}{4} \frac{1}{g_L^2} W^{\mu\nu I 2} - \frac{4}{9} \hbar B^{\mu\nu 2} \text{Log} \left[\frac{\bar{\mu}^2}{M_\phi^2} \right] - \\
& \frac{1}{6} \hbar G^{\mu\nu A 2} \text{Log} \left[\frac{\bar{\mu}^2}{M_\phi^2} \right] + D_\mu \bar{H}_i D_\mu H^i + C_{H^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}_{ai}^r \cdot \gamma_\mu P_L \cdot D_\mu q^{air} \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 + \\
& \hbar \frac{1}{\epsilon} \left(\lambda_{H_X}^{pr} \right)^2 \bar{H}_i \bar{H}_j H^i H^j + \hbar \left(\lambda_{H_X}^{pr} \right)^2 \text{LF}_{1,1,0} [M_\phi, M_X^r] \bar{H}_i \bar{H}_j H^i H^j - \overline{Y_d}^{pr} \bar{H}_i \left(\bar{d}_a^r \cdot P_L \cdot q^{aip} \right) - \\
& \overline{Y_e}^{pr} \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) - Y_d^{rp} H^i \left(\bar{q}_{ai}^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} - \\
& \frac{1}{8} \hbar Y_u^{rt} \overline{\lambda_{\psi_X}}^{ps} \lambda_{\psi_X}^{ts} \bar{H}_i \left(\bar{q}_{aj}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{ji} + \frac{1}{4} \hbar \frac{1}{\epsilon} Y_u^{rt} \overline{\lambda_{\psi_X}}^{ps} \lambda_{\psi_X}^{ts} \bar{H}_i \left(\bar{q}_{aj}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{ji} + \\
& \frac{1}{8} \hbar Y_u^{rt} \overline{\lambda_{\psi_X}}^{ps} \lambda_{\psi_X}^{ts} \text{LF}_{1,1,0} [M_\phi, M_X^s] \bar{H}_i \left(\bar{q}_{aj}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{ji} - \\
& \frac{1}{2} \hbar Y_u^{rt} \overline{\lambda_{\psi_X}}^{ps} \lambda_{\psi_X}^{ts} \text{LF}_{2,1,-1} [M_\phi, M_X^s] \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^{aip} \right) \bar{\epsilon}_{ij} - \\
& \frac{1}{4} \hbar \overline{Y_u}^{ps} \overline{\lambda_{\psi_X}}^{st} \lambda_{\psi_X}^{rt} H^j \left(\bar{u}_a^r \cdot P_L \cdot q^{aip} \right) \bar{\epsilon}_{ij} + \frac{1}{4} \hbar \frac{1}{\epsilon} \overline{Y_u}^{ps} \overline{\lambda_{\psi_X}}^{st} \lambda_{\psi_X}^{rt} H^j \left(\bar{u}_a^r \cdot P_L \cdot q^{aip} \right) \bar{\epsilon}_{ij} + \\
& \frac{1}{2} \hbar \overline{Y_u}^{ps} \overline{\lambda_{\psi_X}}^{st} \lambda_{\psi_X}^{rt} \text{LF}_{1,1,0} [M_\phi, M_X^t] H^j \left(\bar{u}_a^r \cdot P_L \cdot q^{aip} \right) \bar{\epsilon}_{ij} - \\
& \frac{1}{4} \hbar \overline{Y_u}^{ps} \overline{\lambda_{\psi_X}}^{st} \lambda_{\psi_X}^{rt} \text{LF}_{2,1,-1} [M_\phi, M_X^t] H^j \left(\bar{u}_a^r \cdot P_L \cdot q^{aip} \right) \bar{\epsilon}_{ij} + \frac{1}{180} \hbar \frac{1}{M_\phi^2} G^{\mu\nu C} G^{\mu\rho B} G^{\nu\rho A} f^{ABC} - \\
& \frac{4}{45} \hbar C_{H^2} g_Y^4 \frac{1}{M_\phi^2} \bar{H}_i \bar{H}_j H^i H^j + \frac{4}{45} \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 + \\
& 2 \hbar C_{H^2} \left(\lambda_{H_X}^{pr} \right)^2 \text{LF}_{2,1,0} [M_X^p, M_X^r] \bar{H}_i \bar{H}_j H^i H^j - 2 \hbar \lambda \left(\lambda_{H_X}^{pr} \right)^2 \text{LF}_{2,1,0} [M_X^p, M_X^r] \bar{H}_i \bar{H}_j \bar{H}_k H^i H^j H^k - \\
& 2 \hbar C_{H^2} \left(\lambda_{H_X}^{pr} \right)^2 \text{LF}_{3,1,-1} [M_X^p, M_X^r] \bar{H}_i \bar{H}_j H^i H^j + 2 \hbar \lambda \left(\lambda_{H_X}^{pr} \right)^2 \text{LF}_{3,1,-1} [M_X^p, M_X^r] \bar{H}_i \bar{H}_j \bar{H}_k H^i H^j H^k - \\
& \frac{4}{3} \hbar \lambda_{H_X}^{pr} \lambda_{H_X}^{ps} \lambda_{H_X}^{rs} \text{LF}_{1,1,1,0} [M_X^p, M_X^r, M_X^s] \bar{H}_i \bar{H}_j \bar{H}_k H^i H^j H^k - \frac{8}{45} \hbar g_Y^4 \frac{1}{M_\phi^2} D_\mu \bar{H}_i \bar{H}_j H^i D_\mu H^j - \\
& \frac{4}{45} \hbar g_Y^4 \frac{1}{M_\phi^2} \bar{H}_i D_\mu \bar{H}_j H^i D_\mu H^j + 2 \hbar \left(\lambda_{H_X}^{pr} \right)^2 \text{LF}_{2,1,0} [M_X^p, M_X^r] \bar{H}_i D_\mu \bar{H}_j H^i D_\mu H^j - \\
& 2 \hbar \left(\lambda_{H_X}^{pr} \right)^2 \text{LF}_{3,1,-1} [M_X^p, M_X^r] \bar{H}_i D_\mu \bar{H}_j H^i D_\mu H^j + \frac{2}{45} \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) - \\
& \hbar \overline{Y_d}^{pr} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{2,1,0} [M_X^s, M_X^t] \bar{H}_i \bar{H}_j H^i \left(\bar{d}_a^r \cdot P_L \cdot q^{ajp} \right) + \\
& \hbar \overline{Y_d}^{pr} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{3,1,-1} [M_X^s, M_X^t] \bar{H}_i \bar{H}_j H^i \left(\bar{d}_a^r \cdot P_L \cdot q^{ajp} \right) + \\
& \frac{2}{45} \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) - \hbar \overline{Y_e}^{pr} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{2,1,0} [M_X^s, M_X^t] \bar{H}_i \bar{H}_j H^i \left(\bar{e}^r \cdot P_L \cdot l^{jp} \right) + \\
& \hbar \overline{Y_e}^{pr} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{3,1,-1} [M_X^s, M_X^t] \bar{H}_i \bar{H}_j H^i \left(\bar{e}^r \cdot P_L \cdot l^{jp} \right) + \\
& \frac{2}{45} \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) - \hbar Y_e^{rp} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{2,1,0} [M_X^s, M_X^t] \bar{H}_i H^i H^j \left(\bar{l}_j^r \cdot P_R \cdot e^p \right) + \\
& \hbar Y_e^{rp} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{3,1,-1} [M_X^s, M_X^t] \bar{H}_i H^i H^j \left(\bar{l}_j^r \cdot P_R \cdot e^p \right) + \frac{2}{45} \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) - \\
& \hbar Y_d^{rp} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{2,1,0} [M_X^s, M_X^t] \bar{H}_i H^i H^j \left(\bar{q}_{aj}^r \cdot P_R \cdot d^{ap} \right) + \\
& \hbar Y_d^{rp} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{3,1,-1} [M_X^s, M_X^t] \bar{H}_i H^i H^j \left(\bar{q}_{aj}^r \cdot P_R \cdot d^{ap} \right) + \\
& \frac{2}{45} \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}{2} \hbar \overline{Y_u}^{st} Y_u^{rv} Y_u^{sp} \overline{\lambda_{\psi_X}}^{tu} \lambda_{\psi_X}^{vu} \text{LF}_{2,1,0} [M_\phi, M_X^u] \bar{H}_i \bar{H}_j H^i \left(\bar{q}_{ak}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{kj} + \\
& \hbar \overline{Y_u}^{st} Y_u^{rv} Y_u^{sp} \overline{\lambda_{\psi_X}}^{tu} \lambda_{\psi_X}^{vu} \text{LF}_{3,1,-1} [M_\phi, M_X^u] \bar{H}_i \bar{H}_j H^i \left(\bar{q}_{ak}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{kj} - \\
& \frac{1}{2} \hbar \overline{Y_u}^{st} Y_u^{rv} Y_u^{sp} \overline{\lambda_{\psi_X}}^{tu} \lambda_{\psi_X}^{vu} \text{LF}_{4,1,-2} [M_\phi, M_X^u] \bar{H}_i \bar{H}_j H^i \left(\bar{q}_{ak}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{kj} - \\
& \hbar Y_u^{rp} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{2,1,0} [M_X^s, M_X^t] \bar{H}_i \bar{H}_j H^i \left(\bar{q}_{ak}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{kj} + \\
& \hbar Y_u^{rp} \left(\lambda_{H_X}^{st} \right)^2 \text{LF}_{3,1,-1} [M_X^s, M_X^t] \bar{H}_i \bar{H}_j H^i \left(\bar{q}_{ak}^r \cdot P_R \cdot u^{ap} \right) \epsilon^{kj} - \\
& \hbar Y_u^{rt} \lambda_{H_X}^{su} \overline{\lambda_{\psi_X}}^{ps} \lambda_{\psi_X}^{tu} \text{LF}_{1,1,1,0} [M_\phi, M_X^s, M_X^u] \bar{H}_i \bar{H}_j H^i \left(\bar{$$