

$$\begin{aligned}
& \frac{\hbar}{\epsilon} B^{\mu\nu 2} - \frac{1}{4} \frac{B^{\mu\nu 2}}{g_Y^2} - \frac{1}{6} \frac{B^{\mu\nu 2}}{\epsilon} - \frac{1}{6} \frac{G^{\mu\nu A 2}}{\epsilon} - \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{\overline{\mu}^2}{M_\phi^2} \right] - \\
& \frac{1}{6} \hbar G^{\mu\nu A 2} \text{Log} \left[\frac{\overline{\mu}^2}{M_\phi^2} \right] + D_\mu \overline{H}_i D_\mu H^i + C_H^2 \overline{H}_i H^i + i \left(\overline{d}_a^\tau \cdot \gamma_\mu P_R \cdot D_\mu d^{\text{ar}} \right) + i \left(\overline{e}^\tau \cdot \gamma_\mu P_R \cdot D_\mu e^\tau \right) + \\
& i \left(\overline{l}_i^\tau \cdot \gamma_\mu P_L \cdot D_\mu l^{\text{ir}} \right) + i \left(\overline{q}_{a1}^\tau \cdot \gamma_\mu P_L \cdot D_\mu q^{\text{air}} \right) + i \left(\overline{u}_a^\tau \cdot \gamma_\mu P_R \cdot D_\mu u^{\text{ar}} \right) - \frac{1}{2} \lambda \overline{H}_i \overline{H}_j H^i H^j + \\
& \frac{1}{2} \frac{\hbar}{\epsilon} \frac{1}{\lambda_{H_X}^{\text{pr}}} \lambda_{H_X}^{\text{rp}} \overline{H}_i \overline{H}_j H^i H^j + \frac{1}{2} \hbar \lambda_{H_X}^{\text{pr}} \lambda_{H_X}^{\text{rp}} L_{F_{1,1,0}} [M_\phi^{\text{P}}, M_X^{\text{r}}] \overline{H}_i \overline{H}_j H^i H^j - \overline{Y}_d^{\text{pr}} \overline{H}_i \left(\overline{d}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) - \\
& \overline{Y}_e^{\text{pr}} \overline{H}_i \left(\overline{e}^\tau \cdot P_L \cdot l^{\text{ip}} \right) - Y_e^{\text{rp}} H^i \left(\overline{l}_i^\tau \cdot P_R \cdot e^{\text{p}} \right) - Y_d^{\text{rp}} H^i \left(\overline{q}_{a1}^\tau \cdot P_R \cdot d^{\text{ap}} \right) - Y_u^{\text{rp}} \overline{H}_i \left(\overline{q}_{a1}^\tau \cdot P_R \cdot u^{\text{ap}} \right) \varepsilon^{\text{ji}} - \\
& \frac{1}{8} \hbar Y_u^{\text{rt}} \overline{\lambda_{\psi\chi}^{\text{ps}}} \lambda_{\psi\chi}^{\text{ts}} \overline{H}_i \left(\overline{q}_{a1}^\tau \cdot P_R \cdot u^{\text{ap}} \right) \varepsilon^{\text{ji}} + \frac{1}{4} \frac{\hbar}{\epsilon} Y_u^{\text{rt}} \overline{\lambda_{\psi\chi}^{\text{ps}}} \lambda_{\psi\chi}^{\text{ts}} \overline{H}_i \left(\overline{q}_{a1}^\tau \cdot P_R \cdot u^{\text{ap}} \right) \varepsilon^{\text{ji}} + \\
& \frac{1}{2} \hbar Y_u^{\text{rt}} \overline{\lambda_{\psi\chi}^{\text{ps}}} \lambda_{\psi\chi}^{\text{ts}} L_{F_{1,1,0}} [M_\phi^{\text{S}}, M_X^{\text{t}}] \overline{H}_i \left(\overline{q}_{a1}^\tau \cdot P_R \cdot u^{\text{ap}} \right) \varepsilon^{\text{ji}} - \\
& \frac{1}{4} \hbar Y_u^{\text{rt}} \overline{\lambda_{\psi\chi}^{\text{ps}}} \lambda_{\psi\chi}^{\text{ts}} L_{F_{2,1,-1}} [M_\phi^{\text{S}}, M_X^{\text{t}}] \overline{H}_i \left(\overline{q}_{a1}^\tau \cdot P_R \cdot u^{\text{ap}} \right) \varepsilon^{\text{ji}} - \overline{Y}_u^{\text{pr}} H^j \left(\overline{u}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) \overline{\varepsilon}_{ij} - \\
& \frac{1}{8} \hbar \overline{Y}_u^{\text{ps}} \overline{\lambda_{\psi\chi}^{\text{st}}} \lambda_{\psi\chi}^{\text{rt}} H^j \left(\overline{u}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) \overline{\varepsilon}_{ij} + \frac{1}{4} \frac{\hbar}{\epsilon} \overline{Y}_u^{\text{ps}} \overline{\lambda_{\psi\chi}^{\text{st}}} \lambda_{\psi\chi}^{\text{rt}} H^j \left(\overline{u}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) \overline{\varepsilon}_{ij} + \\
& \frac{1}{2} \hbar \overline{Y}_u^{\text{ps}} \overline{\lambda_{\psi\chi}^{\text{st}}} \lambda_{\psi\chi}^{\text{rt}} L_{F_{1,1,0}} [M_\phi^{\text{S}}, M_X^{\text{t}}] H^j \left(\overline{u}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) \overline{\varepsilon}_{ij} - \\
& \frac{1}{4} \hbar \overline{Y}_u^{\text{ps}} \overline{\lambda_{\psi\chi}^{\text{st}}} \lambda_{\psi\chi}^{\text{rt}} L_{F_{2,1,-1}} [M_\phi^{\text{S}}, M_X^{\text{t}}] H^j \left(\overline{u}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) \overline{\varepsilon}_{ij} + \frac{1}{180} \frac{\hbar}{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} \overline{H}_i \overline{H}_j H^i H^j + \frac{4}{45} \hbar \lambda g_Y^4 \frac{1}{M_\phi^2} \overline{H}_i \overline{H}_j \overline{H}_k H^i H^j H^k + \\
& \hbar C_H^2 \lambda_{H_X}^{\text{pr}} \lambda_{H_X}^{\text{rp}} L_{F_{2,1,0}} [M_X^{\text{P}}, M_X^{\text{r}}] \overline{H}_i \overline{H}_j H^i H^j - \hbar \lambda \lambda_{H_X}^{\text{pr}} \lambda_{H_X}^{\text{rp}} L_{F_{2,1,0}} [M_X^{\text{P}}, M_X^{\text{r}}] \overline{H}_i \overline{H}_j \overline{H}_k H^i H^j H^k - \\
& \hbar C_H^2 \lambda_{H_X}^{\text{pr}} \lambda_{H_X}^{\text{rp}} L_{F_{3,1,-1}} [M_X^{\text{P}}, M_X^{\text{r}}] \overline{H}_i \overline{H}_j H^i H^j + \hbar \lambda \lambda_{H_X}^{\text{pr}} \lambda_{H_X}^{\text{rp}} L_{F_{3,1,-1}} [M_X^{\text{P}}, M_X^{\text{r}}] \overline{H}_i \overline{H}_j \overline{H}_k H^i H^j H^k - \\
& \frac{1}{3} \hbar \lambda_{H_X}^{\text{pr}} \overline{\lambda_{H_X}^{\text{rs}}} \lambda_{H_X}^{\text{sp}} L_{F_{1,1,1,0}} [M_X^{\text{P}}, M_X^{\text{r}}, M_X^{\text{S}}] \overline{H}_i \overline{H}_j \overline{H}_k H^i H^j H^k - \frac{8}{45} \hbar g_Y^4 \frac{1}{M_\phi^2} D_\mu \overline{H}_i \overline{H}_j H^i D_\mu H^j - \\
& \frac{4}{45} \hbar g_Y^4 \frac{1}{M_\phi^2} \overline{H}_i D_\mu \overline{H}_j H^i D_\mu H^j + \hbar \lambda_{H_X}^{\text{pr}} \lambda_{H_X}^{\text{rp}} L_{F_{2,1,0}} [M_X^{\text{P}}, M_X^{\text{r}}] \overline{H}_i D_\mu \overline{H}_j H^i D_\mu H^j - \\
& \hbar \lambda_{H_X}^{\text{pr}} \lambda_{H_X}^{\text{rp}} L_{F_{3,1,-1}} [M_X^{\text{P}}, M_X^{\text{r}}] \overline{H}_i D_\mu \overline{H}_j H^i D_\mu H^j + \frac{2}{45} \hbar g_Y^4 \frac{1}{M_\phi^2} \overline{Y}_d^{\text{pr}} \overline{H}_i \overline{H}_j H^i \left(\overline{d}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) - \\
& \frac{1}{2} \hbar \overline{Y}_d^{\text{pr}} \lambda_{H_X}^{\text{st}} \lambda_{H_X}^{\text{ts}} L_{F_{2,1,0}} [M_X^{\text{S}}, M_X^{\text{t}}] \overline{H}_i \overline{H}_j H^i \left(\overline{d}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) + \\
& \frac{1}{2} \hbar \overline{Y}_d^{\text{pr}} \lambda_{H_X}^{\text{st}} \lambda_{H_X}^{\text{ts}} L_{F_{3,1,-1}} [M_X^{\text{S}}, M_X^{\text{t}}] \overline{H}_i \overline{H}_j H^i \left(\overline{d}_a^\tau \cdot P_L \cdot q^{\text{airp}} \right) + \\
& \frac{2}{45} \hbar g_Y^4 \frac{1}{M_\phi^2} \overline{Y}_e^{\text{pr}} \overline{H}_i \overline{H}_j H^i \left(\overline{e}^\tau \cdot P_L \cdot l^{\text{ip}} \right) - \\
& \frac{1}{2} \hbar \overline{Y}_e^{\text{pr}} \lambda_{H_X}^{\text{st}} \lambda_{H_X}^{\text{ts}} L_{F_{2,1,0}} [M_X^{\text{S}}, M_X^{\text{t}}] \overline{H}_i \overline{H}_j H^i \left(\overline{e}^\tau \cdot P_L \cdot l^{\text{ip}} \right) + \\
& \frac{1}{2} \hbar \overline{Y}_e^{\text{pr}} \lambda_{H_X}^{\text{st}} \lambda_{H_X}^{\text{ts}} L_{F_{3,1,-1}} [M_X^{\text{S}}, M_X^{\text{t}}] \overline{H}_i \overline{H}_j H^i \left(\overline{e}^\tau \cdot P_L \cdot l^{\text{ip}} \right) + \\
& \frac{2}{45} \hbar g_Y^4 \frac{1}{M_\phi^2} Y_e^{\text{rp}} \overline{H}_i H^i H^j \left(\overline{l}_j^\tau \cdot P_R \cdot e^{\text{p}} \right) - \\
& \frac{1}{2} \hbar Y_e^{\text{rp}} \lambda_{H_X}^{\text{st}} \lambda_{H_X}^{\text{ts}} L_{F_{2,1,0}} [M_X^{\text{S}}, M_X^{\text{t}}] \overline{H}_i H^i H^j \left(\overline{l}_j^\tau \cdot P_R \cdot e^{\text{p}} \right) + \\
& \frac{1}{2} \hbar Y_e^{\text{rp}} \lambda_{H_X}^{\text{st}} \lambda_{H_X}^{\text{ts}} L_{F_{3,1,-1}} [M_X^{\text{S}}, M_X^{\text{t}}] \overline{H}_i H^i H^j \left(\overline{l}_j^\tau \cdot P_R \cdot e^{\text{p}} \right) + \\
& \frac{2}{45} \hbar g_Y^4 \frac{1}{M_\phi^2} Y_d^{\text{rp}} \overline{H}_i H^i H^j \left(\overline{q}_{a1}^\tau \cdot P_R \cdot d^{\text{ap}} \right) - \\
& \frac{1}{2} \hbar Y_d^{\text{rp}} \lambda_{H_X}^{\text{st}} \lambda_{H_X}^{\text{ts}} L_{F_{2,1,0}} [M_X^{\text{S}}, M_X^{\text{t}}] \overline{H}_i H^i H^j \left(\overline{q}_{a1}^\tau \cdot P_R \cdot d^{\text{ap}} \right) + \\
& \frac{1}{2} \hbar Y_d^{\text{rp}} \lambda_{H_X}^{\text{st}} \lambda_{H_X}^{\text{ts}} L_{F_{3,1,-1}} [M_X^{\text{S}}, M_X^{\text{t}}] \overline{H}_i H^i H^j$$