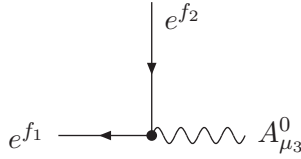


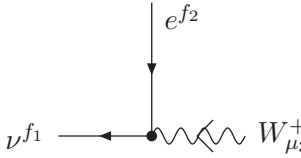
## A SMEFT interaction vertices

### A.1 Lepton–gauge vertices



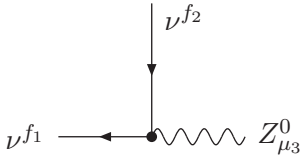
A Feynman diagram showing a vertex where an incoming electron line (labeled  $e^{f1}$ ) and an outgoing electron line (labeled  $e^{f2}$ ) meet at a central point. A wavy line representing a photon (labeled  $A_{\mu 3}^0$ ) extends from this vertex to the right.

$$\begin{aligned}
& + \frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} \delta_{f_1 f_2} \gamma^{\mu_3} - \frac{i\bar{g}^2 \bar{g}'^2 v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} \delta_{f_1 f_2} C^{\varphi W B} \gamma^{\mu_3} \\
& - \frac{\sqrt{2}\bar{g}v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{e B*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{e B} \sigma^{\mu_3 \nu} P_R) \\
& + \frac{\sqrt{2}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{e W*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{e W} \sigma^{\mu_3 \nu} P_R)
\end{aligned}$$



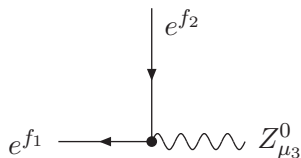
A Feynman diagram showing a vertex where an incoming neutrino line (labeled  $\nu^{f1}$ ) and an outgoing electron line (labeled  $e^{f2}$ ) meet at a central point. A wavy line representing a  $W_{\mu 3}^+$  boson extends from this vertex to the right.

$$-\frac{i\bar{g}}{\sqrt{2}} U_{f_2 f_1}^* \gamma^{\mu_3} P_L - 2v p_3^\nu U_{g_1 f_1}^* C_{g_1 f_2}^{e W} \sigma^{\mu_3 \nu} P_R - \frac{i\bar{g}v^2}{\sqrt{2}} U_{g_1 f_1}^* C_{g_1 f_2}^{\varphi l 3} \gamma^{\mu_3} P_L$$



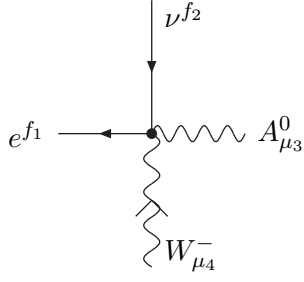
A Feynman diagram showing a vertex where an incoming neutrino line (labeled  $\nu^{f1}$ ) and an outgoing neutrino line (labeled  $\nu^{f2}$ ) meet at a central point. A wavy line representing a photon (labeled  $Z_{\mu 3}^0$ ) extends from this vertex to the right.

$$\begin{aligned}
& + \frac{1}{2} i \sqrt{\bar{g}^2 + \bar{g}'^2} \delta_{f_1 f_2} \gamma^{\mu_3} \gamma^5 + \frac{i\bar{g}\bar{g}'v^2}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} \delta_{f_1 f_2} C^{\varphi W B} \gamma^{\mu_3} \gamma^5 \\
& + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{g_1 g_2}^{\varphi l 1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_3} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_3} P_R) \\
& - \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{g_1 g_2}^{\varphi l 3} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_3} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_3} P_R)
\end{aligned}$$

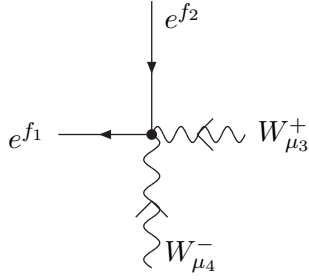


A Feynman diagram showing a vertex where an incoming electron line (labeled  $e^{f1}$ ) and an outgoing electron line (labeled  $e^{f2}$ ) meet at a central point. A wavy line representing a photon (labeled  $Z_{\mu 3}^0$ ) extends from this vertex to the right.

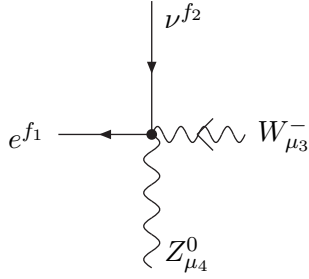
$$\begin{aligned}
& - \frac{i}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} \delta_{f_1 f_2} \left( (\bar{g}'^2 - \bar{g}^2) \gamma^{\mu_3} P_L + 2\bar{g}'^2 \gamma^{\mu_3} P_R \right) \\
& + \frac{i\bar{g}\bar{g}'v^2}{2(\bar{g}^2 + \bar{g}'^2)^{3/2}} \delta_{f_1 f_2} C^{\varphi W B} \left( (\bar{g}'^2 - \bar{g}^2) \gamma^{\mu_3} P_L - 2\bar{g}^2 \gamma^{\mu_3} P_R \right) \\
& + \frac{\sqrt{2}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{e B*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{e B} \sigma^{\mu_3 \nu} P_R) \\
& + \frac{\sqrt{2}\bar{g}v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{e W*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{e W} \sigma^{\mu_3 \nu} P_R) \\
& + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi e} \gamma^{\mu_3} P_R \\
& + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi l 1} \gamma^{\mu_3} P_L + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi l 3} \gamma^{\mu_3} P_L
\end{aligned}$$



$$+ \frac{2\bar{g}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} U_{g_1 f_2} \sigma^{\mu_3 \mu_4} P_L C_{g_1 f_1}^{eW*}$$

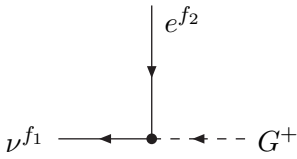


$$+ \sqrt{2}\bar{g}v \left( \sigma^{\mu_3 \mu_4} P_L C_{f_2 f_1}^{eW*} + C_{f_1 f_2}^{eW} \sigma^{\mu_3 \mu_4} P_R \right)$$

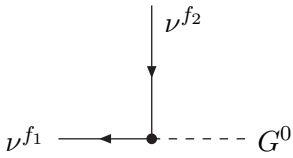


$$- \frac{2\bar{g}^2 v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} U_{g_1 f_2} \sigma^{\mu_3 \mu_4} P_L C_{g_1 f_1}^{eW*}$$

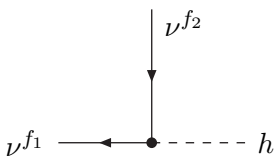
## A.2 Lepton-Higgs-gauge vertices



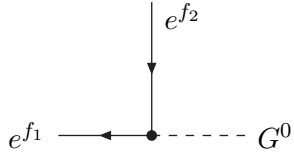
$$+ \frac{i\sqrt{2}}{v} U_{f_2 f_1}^* \left( m_{\nu_{f_1}} P_L - m_{l_{f_2}} P_R \right) + i\sqrt{2}v \not{p}_3 P_L U_{g_1 f_1}^* C_{g_1 f_2}^{\varphi l 3}$$



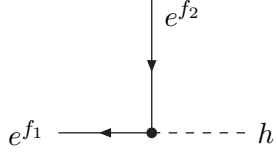
$$- \frac{2}{v} m_{\nu_{f_1}} \delta_{f_1 f_2} \gamma^5 - v C_{g_1 g_2}^{\varphi l 1} \left( U_{g_2 f_2} \not{p}_3 P_L U_{g_1 f_1}^* - U_{g_2 f_1} \not{p}_3 P_R U_{g_1 f_2}^* \right) \\ + v C_{g_1 g_2}^{\varphi l 3} \left( U_{g_2 f_2} \not{p}_3 P_L U_{g_1 f_1}^* - U_{g_2 f_1} \not{p}_3 P_R U_{g_1 f_2}^* \right)$$



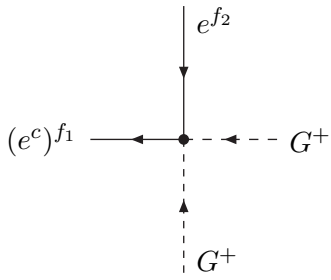
$$- \frac{2i}{v} m_{\nu_{f_1}} \delta_{f_1 f_2}$$



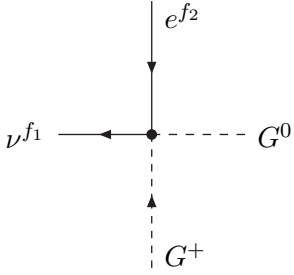
$$+\frac{1}{v}m_{l_{f_1}}\delta_{f_1f_2}\gamma^5-\frac{v}{4}m_{l_{f_1}}\delta_{f_1f_2}C^{\varphi D}\gamma^5-v\not{p}_3P_R C^{\varphi e}_{f_1f_2}-v\not{p}_3P_L C^{\varphi l1}_{f_1f_2}-v\not{p}_3P_L C^{\varphi l3}_{f_1f_2}$$



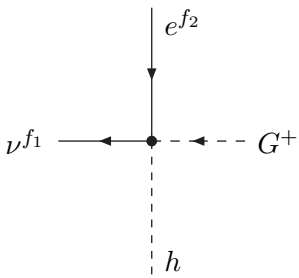
$$-\frac{i}{v}m_{l_{f_1}}\delta_{f_1f_2}-ivm_{l_{f_1}}\delta_{f_1f_2}C^{\varphi\Box}+\frac{iv}{4}m_{l_{f_1}}\delta_{f_1f_2}C^{\varphi D}+\frac{iv^2}{\sqrt{2}}\left(P_L C^{e\varphi*}_{f_2f_1}+P_R C^{e\varphi}_{f_1f_2}\right)$$



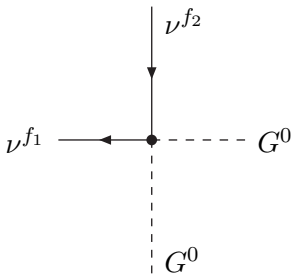
$$-\frac{4i}{v^2}m_{\nu_{g_1}}P_L U^*_{f_1g_1}U^*_{f_2g_1}$$



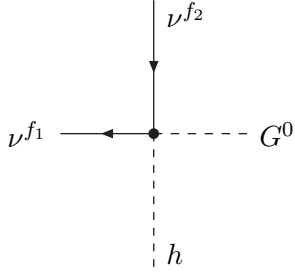
$$-\frac{\sqrt{2}}{v^2}m_{\nu_{f_1}}P_L U^*_{f_2f_1}-\sqrt{2}\left(\not{p}_3P_L-\not{p}_4P_L\right)U^*_{g_1f_1}C^{\varphi l3}_{g_1f_2}$$



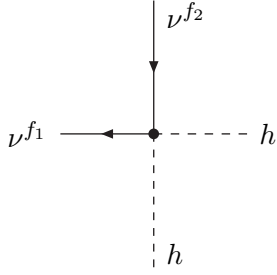
$$+\frac{i\sqrt{2}}{v^2}m_{\nu_{f_1}}P_L U^*_{f_2f_1}+ivP_R U^*_{g_1f_1}C^{e\varphi}_{g_1f_2}+i\sqrt{2}\left(\not{p}_3P_L-\not{p}_4P_L\right)U^*_{g_1f_1}C^{\varphi l3}_{g_1f_2}$$



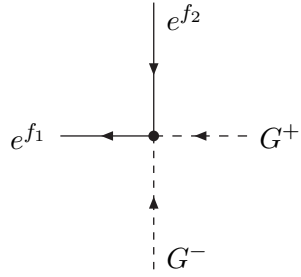
$$+\frac{2i}{v^2}m_{\nu_{f_1}}\delta_{f_1f_2}$$



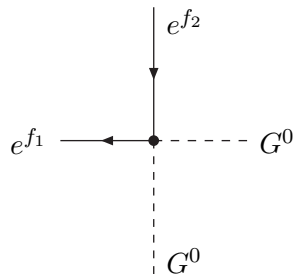
$$\begin{aligned}
& -\frac{2}{v^2} m_{\nu_{f_1}} \delta_{f_1 f_2} \gamma^5 \\
& - C_{g_1 g_2}^{\varphi l 1} \left( U_{g_2 f_2} \left( \not{p}_3 P_L - \not{p}_4 P_L \right) U_{g_1 f_1}^* + U_{g_2 f_1} \left( \not{p}_4 P_R - \not{p}_3 P_R \right) U_{g_1 f_2}^* \right) \\
& + C_{g_1 g_2}^{\varphi l 3} \left( U_{g_2 f_2} \left( \not{p}_3 P_L - \not{p}_4 P_L \right) U_{g_1 f_1}^* + U_{g_2 f_1} \left( \not{p}_4 P_R - \not{p}_3 P_R \right) U_{g_1 f_2}^* \right)
\end{aligned}$$



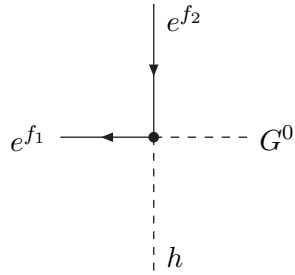
$$-\frac{2i}{v^2} m_{\nu_{f_1}} \delta_{f_1 f_2}$$



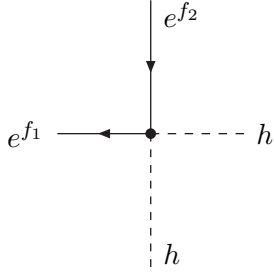
$$\begin{aligned}
& + \frac{iv}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} + P_R C_{f_1 f_2}^{e\varphi} \right) + i \left( \not{p}_3 P_R - \not{p}_4 P_R \right) C_{f_1 f_2}^{\varphi e} \\
& + i \left( \not{p}_3 P_L - \not{p}_4 P_L \right) C_{f_1 f_2}^{\varphi l 1} - i \left( \not{p}_3 P_L - \not{p}_4 P_L \right) C_{f_1 f_2}^{\varphi l 3}
\end{aligned}$$



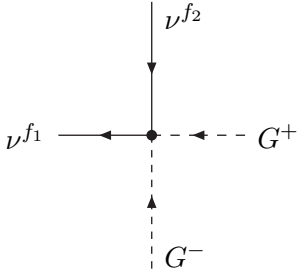
$$+ \frac{iv}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} + P_R C_{f_1 f_2}^{e\varphi} \right)$$



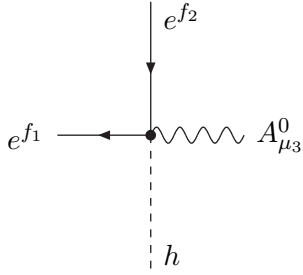
$$\begin{aligned}
& + \frac{v}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} - P_R C_{f_1 f_2}^{e\varphi} \right) - \left( \not{p}_3 P_R - \not{p}_4 P_R \right) C_{f_1 f_2}^{\varphi e} \\
& - \left( \not{p}_3 P_L - \not{p}_4 P_L \right) C_{f_1 f_2}^{\varphi l 1} - \left( \not{p}_3 P_L - \not{p}_4 P_L \right) C_{f_1 f_2}^{\varphi l 3}
\end{aligned}$$



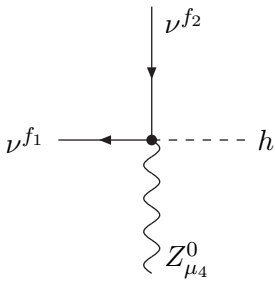
$$+\frac{3iv}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} + P_R C_{f_1 f_2}^{e\varphi} \right)$$



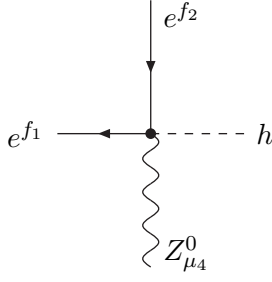
$$+iC_{g_1 g_2}^{\varphi l1} \left( U_{g_2 f_2} (\not{p}_3 P_L - \not{p}_4 P_L) U_{g_1 f_1}^* + U_{g_2 f_1} (\not{p}_4 P_R - \not{p}_3 P_R) U_{g_1 f_2}^* \right) \\ +iC_{g_1 g_2}^{\varphi l3} \left( U_{g_2 f_2} (\not{p}_3 P_L - \not{p}_4 P_L) U_{g_1 f_1}^* + U_{g_2 f_1} (\not{p}_4 P_R - \not{p}_3 P_R) U_{g_1 f_2}^* \right)$$



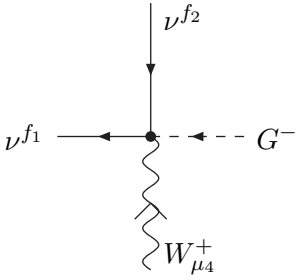
$$-\frac{\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{eB*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{eB} \sigma^{\mu_3 \nu} P_R) \\ +\frac{\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{eW*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{eW} \sigma^{\mu_3 \nu} P_R)$$



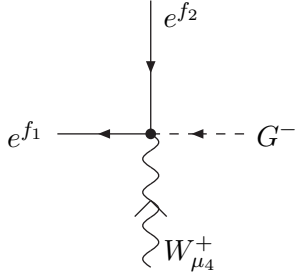
$$+iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{g_1 g_2}^{\varphi l1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_4} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_4} P_R) \\ -iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{g_1 g_2}^{\varphi l3} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_4} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_4} P_R)$$



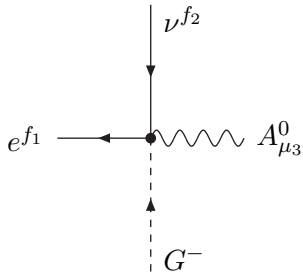
$$\begin{aligned}
& + \frac{\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{eB*} \sigma^{\mu_4 \nu} P_L + C_{f_1 f_2}^{eB} \sigma^{\mu_4 \nu} P_R) \\
& + \frac{\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{eW*} \sigma^{\mu_4 \nu} P_L + C_{f_1 f_2}^{eW} \sigma^{\mu_4 \nu} P_R) \\
& + iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi e} \gamma^{\mu_4} P_R \\
& + iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi l1} \gamma^{\mu_4} P_L + iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi l3} \gamma^{\mu_4} P_L
\end{aligned}$$



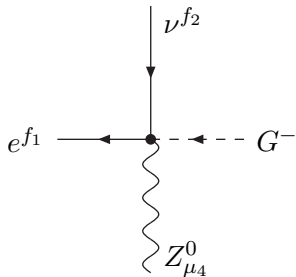
$$-i\bar{g}vC_{g_1 g_2}^{\varphi l1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_4} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_4} P_R)$$



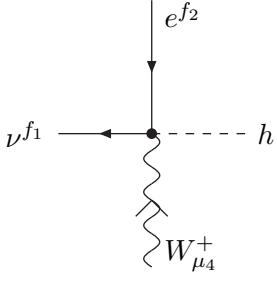
$$-2\sqrt{2}p_4^\nu C_{f_2 f_1}^{eW*} \sigma^{\mu_4 \nu} P_L - i\bar{g}vC_{f_1 f_2}^{\varphi e} \gamma^{\mu_4} P_R - i\bar{g}vC_{f_1 f_2}^{\varphi l1} \gamma^{\mu_4} P_L$$



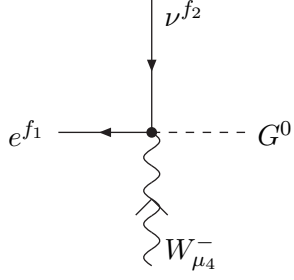
$$\begin{aligned}
& - \frac{2\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu U_{g_1 f_2} \sigma^{\mu_3 \nu} P_L C_{g_1 f_1}^{eB*} - \frac{2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu U_{g_1 f_2} \sigma^{\mu_3 \nu} P_L C_{g_1 f_1}^{eW*} \\
& - \frac{i\sqrt{2}\bar{g}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} U_{g_1 f_2} C_{f_1 g_1}^{\varphi l3} \gamma^{\mu_3} P_L
\end{aligned}$$



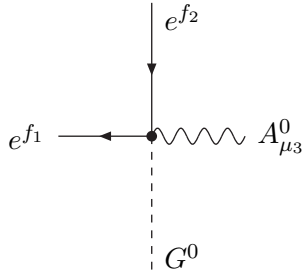
$$\begin{aligned}
& + \frac{2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu U_{g_1 f_2} \sigma^{\mu_4 \nu} P_L C_{g_1 f_1}^{eB*} - \frac{2\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu U_{g_1 f_2} \sigma^{\mu_4 \nu} P_L C_{g_1 f_1}^{eW*} \\
& + \frac{i\sqrt{2}\bar{g}'^2 v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} U_{g_1 f_2} C_{f_1 g_1}^{\varphi l3} \gamma^{\mu_4} P_L
\end{aligned}$$



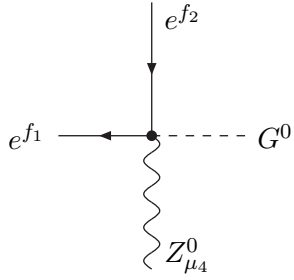
$$-2p_4^\nu U_{g_1 f_1}^* C_{g_1 f_2}^{eW} \sigma^{\mu_4 \nu} P_R - i\sqrt{2}\bar{g}v U_{g_1 f_1}^* C_{g_1 f_2}^{\varphi l3} \gamma^{\mu_4} P_L$$



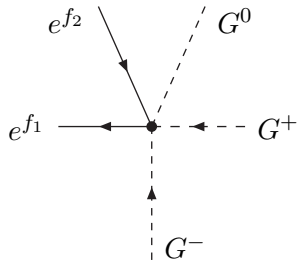
$$+2ip_4^\nu U_{g_1 f_2} \sigma^{\mu_4 \nu} P_L C_{g_1 f_1}^{eW*}$$



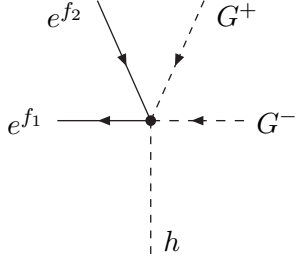
$$+\frac{i\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{eB*} \sigma^{\mu_3 \nu} P_L - C_{f_1 f_2}^{eB} \sigma^{\mu_3 \nu} P_R) \\ - \frac{i\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{eW*} \sigma^{\mu_3 \nu} P_L - C_{f_1 f_2}^{eW} \sigma^{\mu_3 \nu} P_R)$$



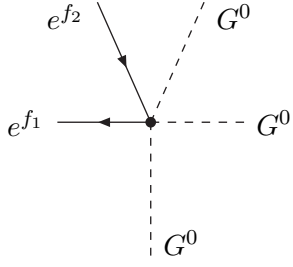
$$-\frac{i\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{eB*} \sigma^{\mu_4 \nu} P_L - C_{f_1 f_2}^{eB} \sigma^{\mu_4 \nu} P_R) \\ - \frac{i\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{eW*} \sigma^{\mu_4 \nu} P_L - C_{f_1 f_2}^{eW} \sigma^{\mu_4 \nu} P_R)$$



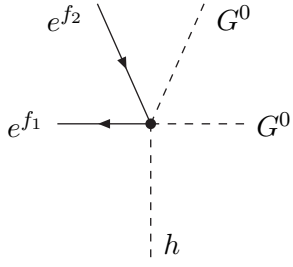
$$+\frac{1}{\sqrt{2}} (P_L C_{f_2 f_1}^{e\varphi*} - P_R C_{f_1 f_2}^{e\varphi})$$



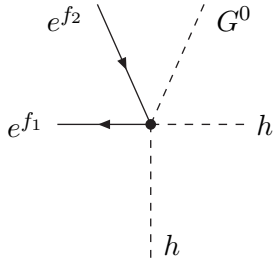
$$+\frac{i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} + P_R C_{f_1 f_2}^{e\varphi} \right)$$



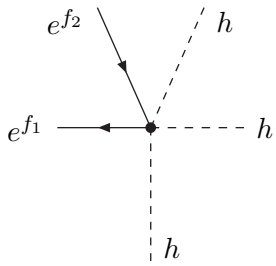
$$+\frac{3}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} - P_R C_{f_1 f_2}^{e\varphi} \right)$$



$$+\frac{i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} + P_R C_{f_1 f_2}^{e\varphi} \right)$$

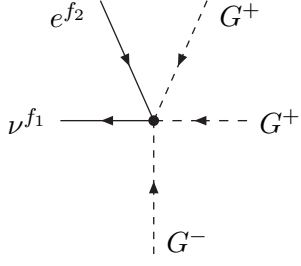


$$+\frac{1}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} - P_R C_{f_1 f_2}^{e\varphi} \right)$$

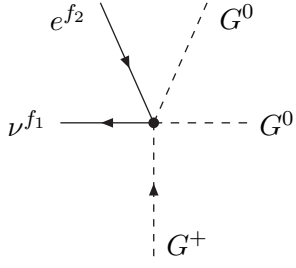


$$+\frac{3i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{e\varphi*} + P_R C_{f_1 f_2}^{e\varphi} \right)$$

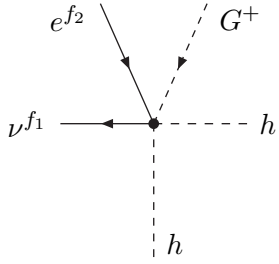




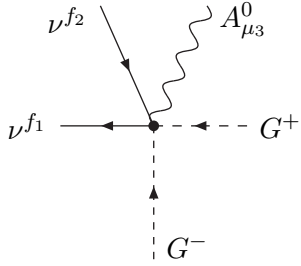
$$+2iP_R U_{g_1 f_1}^* C_{g_1 f_2}^{e\varphi}$$



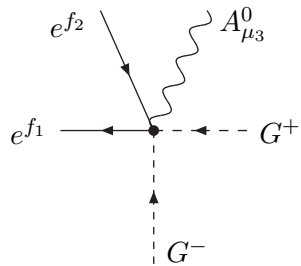
$$+iP_R U_{g_1 f_1}^* C_{g_1 f_2}^{e\varphi}$$



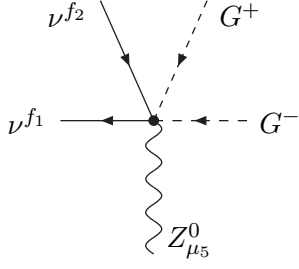
$$+iP_R U_{g_1 f_1}^* C_{g_1 f_2}^{e\varphi}$$



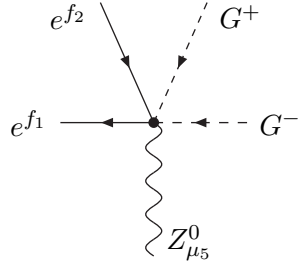
$$\begin{aligned} & -\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{g_1 g_2}^{\varphi l 1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_3} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_3} P_R) \\ & -\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{g_1 g_2}^{\varphi l 3} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_3} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_3} P_R) \end{aligned}$$



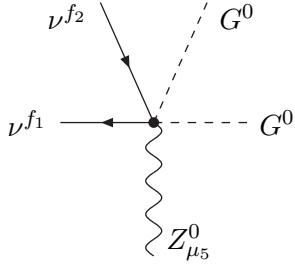
$$-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi e} \gamma^{\mu_3} P_R - \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi l 1} \gamma^{\mu_3} P_L + \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi l 3} \gamma^{\mu_3} P_L$$



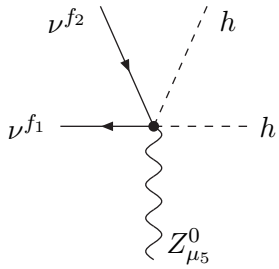
$$\begin{aligned}
& + \frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{g_1 g_2}^{\varphi l 1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_5} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_5} P_R) \\
& + \frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{g_1 g_2}^{\varphi l 3} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_5} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_5} P_R)
\end{aligned}$$



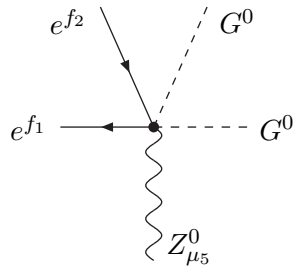
$$\begin{aligned}
& + \frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi e} \gamma^{\mu_5} P_R + \frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi l 1} \gamma^{\mu_5} P_L \\
& - \frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi l 3} \gamma^{\mu_5} P_L
\end{aligned}$$



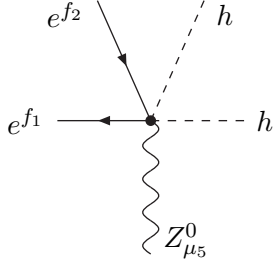
$$\begin{aligned}
& + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{g_1 g_2}^{\varphi l 1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_5} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_5} P_R) \\
& - i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{g_1 g_2}^{\varphi l 3} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_5} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_5} P_R)
\end{aligned}$$



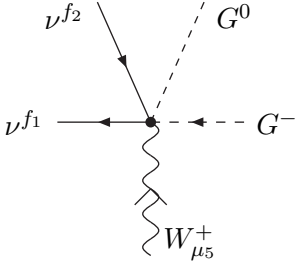
$$\begin{aligned}
& + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{g_1 g_2}^{\varphi l 1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_5} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_5} P_R) \\
& - i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{g_1 g_2}^{\varphi l 3} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_5} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_5} P_R)
\end{aligned}$$



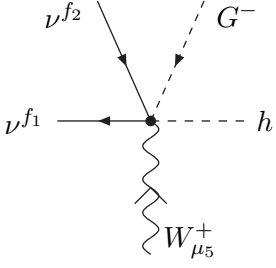
$$+ i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi e} \gamma^{\mu_5} P_R + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi l 1} \gamma^{\mu_5} P_L + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi l 3} \gamma^{\mu_5} P_L$$



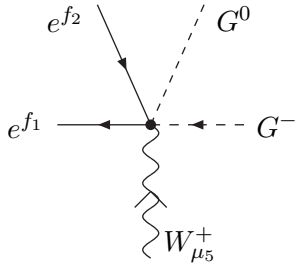
$$+i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi e} \gamma^{\mu_5} P_R + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi l1} \gamma^{\mu_5} P_L + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi l3} \gamma^{\mu_5} P_L$$



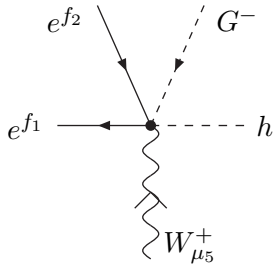
$$+\bar{g} C_{g_1 g_2}^{\varphi l1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_5} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_5} P_R)$$



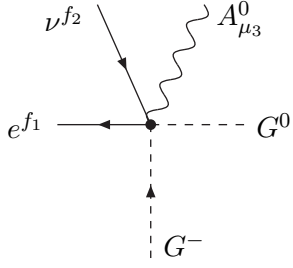
$$-i\bar{g} C_{g_1 g_2}^{\varphi l1} (U_{g_2 f_2} U_{g_1 f_1}^* \gamma^{\mu_5} P_L - U_{g_2 f_1} U_{g_1 f_2}^* \gamma^{\mu_5} P_R)$$



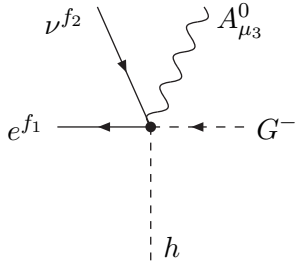
$$+\bar{g} C_{f_1 f_2}^{\varphi e} \gamma^{\mu_5} P_R + \bar{g} C_{f_1 f_2}^{\varphi l1} \gamma^{\mu_5} P_L$$



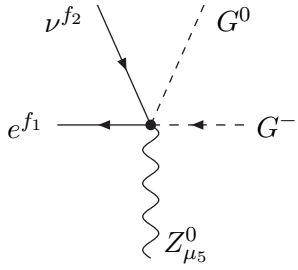
$$-i\bar{g} C_{f_1 f_2}^{\varphi e} \gamma^{\mu_5} P_R - i\bar{g} C_{f_1 f_2}^{\varphi l1} \gamma^{\mu_5} P_L$$



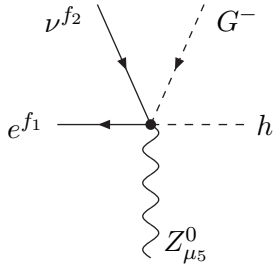
$$+ \frac{\sqrt{2}\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} U_{g_1 f_2} C_{f_1 g_1}^{\varphi l 3} \gamma^{\mu_3} P_L$$



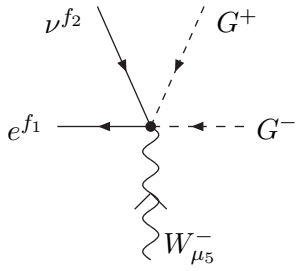
$$- \frac{i\sqrt{2}\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} U_{g_1 f_2} C_{f_1 g_1}^{\varphi l 3} \gamma^{\mu_3} P_L$$



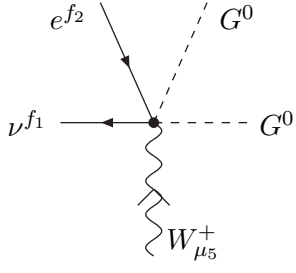
$$- \frac{\sqrt{2}\bar{g}'^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} U_{g_1 f_2} C_{f_1 g_1}^{\varphi l 3} \gamma^{\mu_5} P_L$$



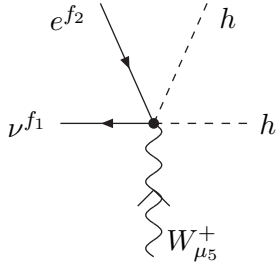
$$+ \frac{i\sqrt{2}\bar{g}'^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} U_{g_1 f_2} C_{f_1 g_1}^{\varphi l 3} \gamma^{\mu_5} P_L$$



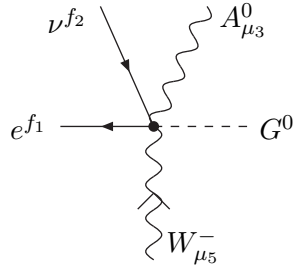
$$- i\sqrt{2}\bar{g} U_{g_1 f_2} C_{f_1 g_1}^{\varphi l 3} \gamma^{\mu_5} P_L$$



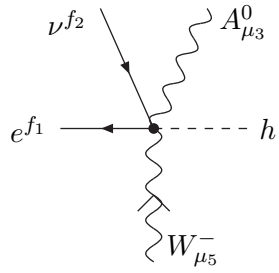
$$-i\sqrt{2}\bar{g}U_{g_1f_1}^*C_{g_1f_2}^{\varphi l3}\gamma^{\mu_5}P_L$$



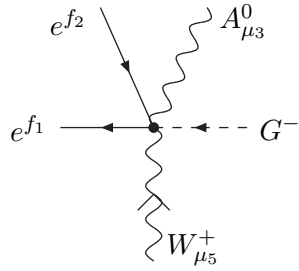
$$-i\sqrt{2}\bar{g}U_{g_1f_1}^*C_{g_1f_2}^{\varphi l3}\gamma^{\mu_5}P_L$$



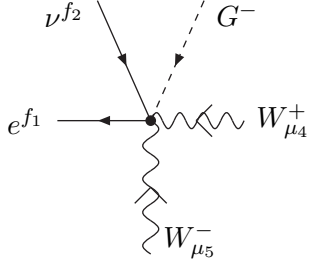
$$-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}U_{g_1f_2}\sigma^{\mu_3\mu_5}P_L C_{g_1f_1}^{eW*}$$



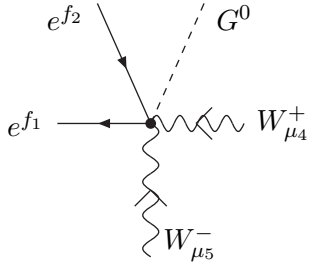
$$+\frac{2\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}U_{g_1f_2}\sigma^{\mu_3\mu_5}P_L C_{g_1f_1}^{eW*}$$



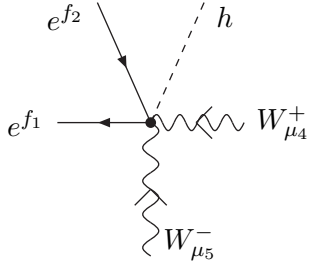
$$-\frac{2\sqrt{2}\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}\sigma^{\mu_3\mu_5}P_L C_{f_2f_1}^{eW*}$$



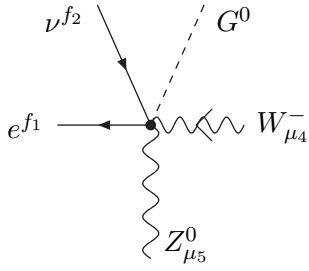
$$-2\bar{g}U_{g_1 f_2}\sigma^{\mu_4\mu_5}P_L C_{g_1 f_1}^{eW*}$$



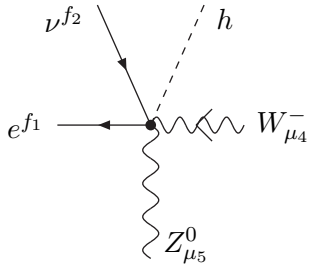
$$-i\sqrt{2}\bar{g}\left(\sigma^{\mu_4\mu_5}P_L C_{f_2 f_1}^{eW*} - C_{f_1 f_2}^{eW}\sigma^{\mu_4\mu_5}P_R\right)$$



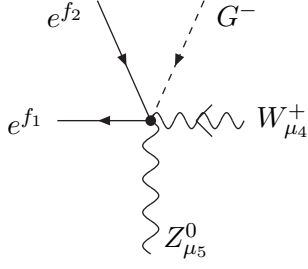
$$+\sqrt{2}\bar{g}\left(\sigma^{\mu_4\mu_5}P_L C_{f_2 f_1}^{eW*} + C_{f_1 f_2}^{eW}\sigma^{\mu_4\mu_5}P_R\right)$$



$$+\frac{2i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}}U_{g_1 f_2}\sigma^{\mu_4\mu_5}P_L C_{g_1 f_1}^{eW*}$$

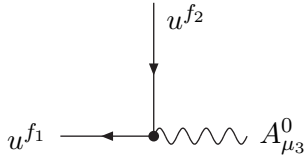


$$-\frac{2\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}}U_{g_1 f_2}\sigma^{\mu_4\mu_5}P_L C_{g_1 f_1}^{eW*}$$

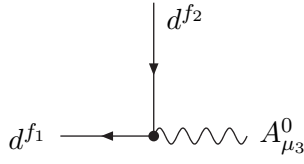


$$+ \frac{2\sqrt{2}\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} \sigma^{\mu_4\mu_5} P_L C_{f_2f_1}^{eW*}$$

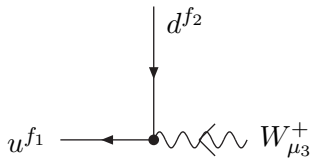
### A.3 Quark–gauge vertices



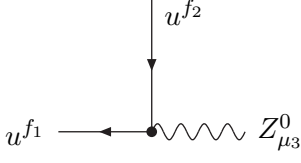
$$\begin{aligned} & -\frac{2i\bar{g}\bar{g}'}{3\sqrt{\bar{g}^2 + \bar{g}'^2}} \delta_{f_1f_2} \gamma^{\mu_3} + \frac{2i\bar{g}^2\bar{g}'^2v^2}{3(\bar{g}^2 + \bar{g}'^2)^{3/2}} \delta_{f_1f_2} C^{\varphi WB} \gamma^{\mu_3} \\ & - \frac{\sqrt{2}\bar{g}v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2f_1}^{uB*} \sigma^{\mu_3\nu} P_L + C_{f_1f_2}^{uB} \sigma^{\mu_3\nu} P_R) \\ & - \frac{\sqrt{2}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2f_1}^{uW*} \sigma^{\mu_3\nu} P_L + C_{f_1f_2}^{uW} \sigma^{\mu_3\nu} P_R) \end{aligned}$$



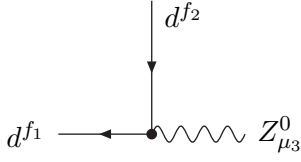
$$\begin{aligned} & + \frac{i\bar{g}\bar{g}'}{3\sqrt{\bar{g}^2 + \bar{g}'^2}} \delta_{f_1f_2} \gamma^{\mu_3} - \frac{i\bar{g}^2\bar{g}'^2v^2}{3(\bar{g}^2 + \bar{g}'^2)^{3/2}} \delta_{f_1f_2} C^{\varphi WB} \gamma^{\mu_3} \\ & - \frac{\sqrt{2}\bar{g}v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2f_1}^{dB*} \sigma^{\mu_3\nu} P_L + C_{f_1f_2}^{dB} \sigma^{\mu_3\nu} P_R) \\ & + \frac{\sqrt{2}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2f_1}^{dW*} \sigma^{\mu_3\nu} P_L + C_{f_1f_2}^{dW} \sigma^{\mu_3\nu} P_R) \end{aligned}$$



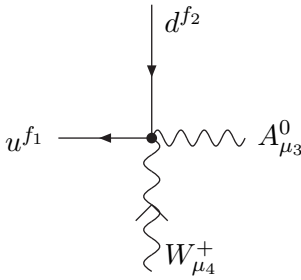
$$\begin{aligned} & -\frac{i\bar{g}}{\sqrt{2}} K_{f_1f_2} \gamma^{\mu_3} P_L - 2vp_3^\nu K_{f_1g_1} C_{g_1f_2}^{dW} \sigma^{\mu_3\nu} P_R - \frac{i\bar{g}v^2}{\sqrt{2}} K_{f_1g_1} C_{g_1f_2}^{\varphi q3} \gamma^{\mu_3} P_L \\ & - \frac{i\bar{g}v^2}{2\sqrt{2}} C_{f_1f_2}^{\varphi ud} \gamma^{\mu_3} P_R - 2vp_3^\nu K_{g_1f_2} \sigma^{\mu_3\nu} P_L C_{g_1f_1}^{uW*} \end{aligned}$$



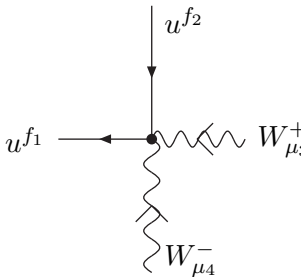
$$\begin{aligned}
& + \frac{i}{6\sqrt{\bar{g}^2 + \bar{g}'^2}} \delta_{f_1 f_2} \left( (\bar{g}'^2 - 3\bar{g}^2) \gamma^{\mu_3} P_L + 4\bar{g}'^2 \gamma^{\mu_3} P_R \right) \\
& - \frac{i\bar{g}\bar{g}'v^2}{6(\bar{g}^2 + \bar{g}'^2)^{3/2}} \delta_{f_1 f_2} C^{\varphi WB} \left( (3\bar{g}'^2 - \bar{g}^2) \gamma^{\mu_3} P_L - 4\bar{g}^2 \gamma^{\mu_3} P_R \right) \\
& + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 1} \gamma^{\mu_3} P_L \\
& - \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 3} \gamma^{\mu_3} P_L \\
& + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi u} \gamma^{\mu_3} P_R \\
& + \frac{\sqrt{2}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{u B*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{u B} \sigma^{\mu_3 \nu} P_R) \\
& - \frac{\sqrt{2}\bar{g}v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{u W*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{u W} \sigma^{\mu_3 \nu} P_R)
\end{aligned}$$



$$\begin{aligned}
& + \frac{i}{6\sqrt{\bar{g}^2 + \bar{g}'^2}} \delta_{f_1 f_2} \left( (3\bar{g}^2 + \bar{g}'^2) \gamma^{\mu_3} P_L - 2\bar{g}'^2 \gamma^{\mu_3} P_R \right) \\
& + \frac{i\bar{g}\bar{g}'v^2}{6(\bar{g}^2 + \bar{g}'^2)^{3/2}} \delta_{f_1 f_2} C^{\varphi WB} \left( (\bar{g}^2 + 3\bar{g}'^2) \gamma^{\mu_3} P_L - 2\bar{g}^2 \gamma^{\mu_3} P_R \right) \\
& + \frac{\sqrt{2}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{dB*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{dB} \sigma^{\mu_3 \nu} P_R) \\
& + \frac{\sqrt{2}\bar{g}v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{dW*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{dW} \sigma^{\mu_3 \nu} P_R) \\
& + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi d} \gamma^{\mu_3} P_R \\
& + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi q 1} \gamma^{\mu_3} P_L + \frac{1}{2} i v^2 \sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi q 3} \gamma^{\mu_3} P_L
\end{aligned}$$

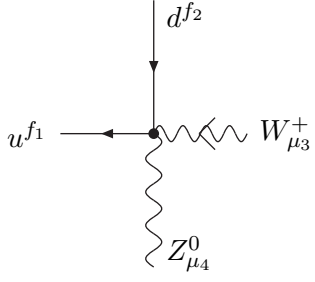


$$- \frac{2\bar{g}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_1 g_1} \sigma^{\mu_3 \mu_4} P_R C_{g_1 f_2}^{dW} - \frac{2\bar{g}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{g_1 f_2} \sigma^{\mu_3 \mu_4} P_L C_{g_1 f_1}^{uW*}$$

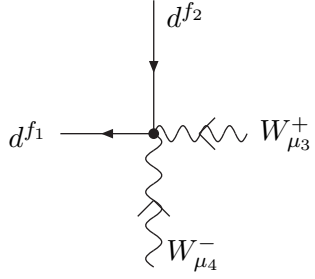


$$- \sqrt{2}\bar{g}v (\sigma^{\mu_3 \mu_4} P_L C_{f_2 f_1}^{uW*} + C_{f_1 f_2}^{uW} \sigma^{\mu_3 \mu_4} P_R)$$



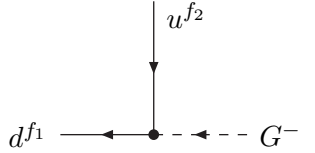


$$+ \frac{2\bar{g}^2 v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_1 g_1} \sigma^{\mu_3 \mu_4} P_R C_{g_1 f_2}^{dW} + \frac{2\bar{g}^2 v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{g_1 f_2} \sigma^{\mu_3 \mu_4} P_L C_{g_1 f_1}^{uW*}$$

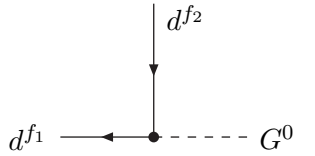


$$+ \sqrt{2} \bar{g} v \left( \sigma^{\mu_3 \mu_4} P_L C_{f_2 f_1}^{dW*} + C_{f_1 f_2}^{dW} \sigma^{\mu_3 \mu_4} P_R \right)$$

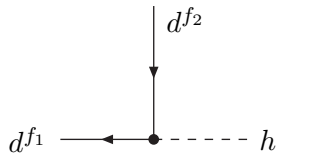
#### A.4 Quark-Higgs-gauge vertices



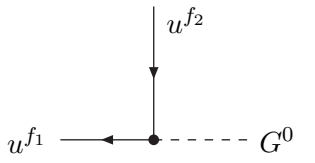
$$- \frac{i\sqrt{2}}{v} K_{f_2 f_1}^* \left( m_{d_{f_1}} P_L - m_{u_{f_2}} P_R \right) - i\sqrt{2} v \not{p}_3 P_L K_{f_2 g_1}^* C_{f_1 g_1}^{\varphi q 3} - \frac{iv}{\sqrt{2}} \not{p}_3 P_R C_{f_2 f_1}^{\varphi u d*}$$



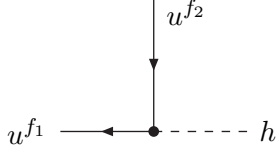
$$+ \frac{1}{v} m_{d_{f_1}} \delta_{f_1 f_2} \gamma^5 - \frac{v}{4} m_{d_{f_1}} \delta_{f_1 f_2} C^{\varphi D} \gamma^5 - v \not{p}_3 P_R C_{f_1 f_2}^{\varphi d} - v \not{p}_3 P_L C_{f_1 f_2}^{\varphi q 1} - v \not{p}_3 P_L C_{f_1 f_2}^{\varphi q 3}$$



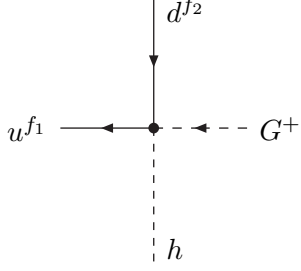
$$- \frac{i}{v} m_{d_{f_1}} \delta_{f_1 f_2} - i v m_{d_{f_1}} \delta_{f_1 f_2} C^{\varphi \square} + \frac{iv}{4} m_{d_{f_1}} \delta_{f_1 f_2} C^{\varphi D} + \frac{iv^2}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} + P_R C_{f_1 f_2}^{d\varphi} \right)$$



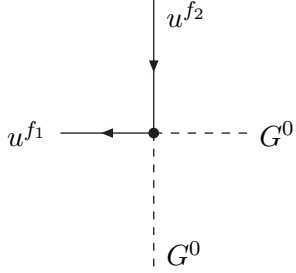
$$- \frac{1}{v} m_{u_{f_1}} \delta_{f_1 f_2} \gamma^5 + \frac{v}{4} m_{u_{f_1}} \delta_{f_1 f_2} C^{\varphi D} \gamma^5 - v K_{f_1 g_2} \not{p}_3 P_L K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 1} \\ + v K_{f_1 g_2} \not{p}_3 P_L K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 3} - v \not{p}_3 P_R C_{f_1 f_2}^{\varphi u}$$



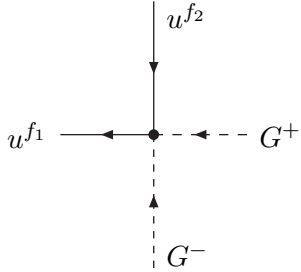
$$-\frac{i}{v}m_{u_{f_1}}\delta_{f_1f_2}-ivm_{u_{f_1}}\delta_{f_1f_2}C^{\varphi\Box}+\frac{iv}{4}m_{u_{f_1}}\delta_{f_1f_2}C^{\varphi D}+\frac{iv^2}{\sqrt{2}}\left(P_L C_{f_2f_1}^{u\varphi*}+P_R C_{f_1f_2}^{u\varphi}\right)$$



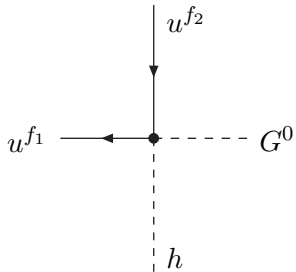
$$+ivP_R K_{f_1g_1}C_{g_1f_2}^{d\varphi}+i\sqrt{2}K_{f_1g_1}\left(\not{p}_3P_L-\not{p}_4P_L\right)C_{g_1f_2}^{\varphi q^3} \\ +\frac{i}{\sqrt{2}}\left(\not{p}_3P_R-\not{p}_4P_R\right)C_{f_1f_2}^{\varphi ud}-ivP_L K_{g_1f_2}C_{g_1f_1}^{u\varphi*}$$



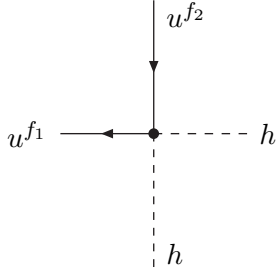
$$+\frac{iv}{\sqrt{2}}\left(P_L C_{f_2f_1}^{u\varphi*}+P_R C_{f_1f_2}^{u\varphi}\right)$$



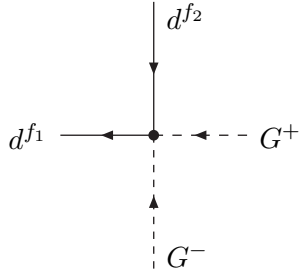
$$+iK_{f_1g_2}\left(\not{p}_3P_L-\not{p}_4P_L\right)K_{f_2g_1}^*C_{g_2g_1}^{\varphi q^1}+iK_{f_1g_2}\left(\not{p}_3P_L-\not{p}_4P_L\right)K_{f_2g_1}^*C_{g_2g_1}^{\varphi q^3} \\ +i\left(\not{p}_3P_R-\not{p}_4P_R\right)C_{f_1f_2}^{\varphi u}+\frac{iv}{\sqrt{2}}\left(P_L C_{f_2f_1}^{u\varphi*}+P_R C_{f_1f_2}^{u\varphi}\right)$$



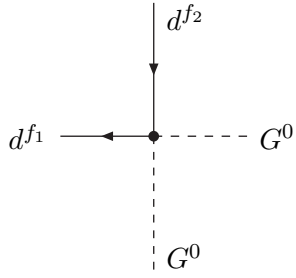
$$-K_{f_1g_2}\left(\not{p}_3P_L-\not{p}_4P_L\right)K_{f_2g_1}^*C_{g_2g_1}^{\varphi q^1}+K_{f_1g_2}\left(\not{p}_3P_L-\not{p}_4P_L\right)K_{f_2g_1}^*C_{g_2g_1}^{\varphi q^3} \\ -\left(\not{p}_3P_R-\not{p}_4P_R\right)C_{f_1f_2}^{\varphi u}-\frac{v}{\sqrt{2}}\left(P_L C_{f_2f_1}^{u\varphi*}-P_R C_{f_1f_2}^{u\varphi}\right)$$



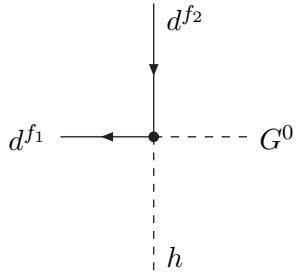
$$+\frac{3iv}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{u\varphi*} + P_R C_{f_1 f_2}^{u\varphi} \right)$$



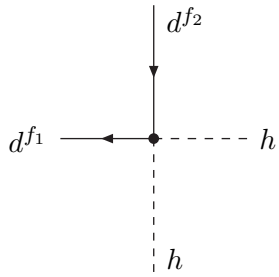
$$+\frac{iv}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} + P_R C_{f_1 f_2}^{d\varphi} \right) + i \left( \not{p}_3 P_R - \not{p}_4 P_R \right) C_{f_1 f_2}^{\varphi d} \\ + i \left( \not{p}_3 P_L - \not{p}_4 P_L \right) C_{f_1 f_2}^{\varphi q^1} - i \left( \not{p}_3 P_L - \not{p}_4 P_L \right) C_{f_1 f_2}^{\varphi q^3}$$



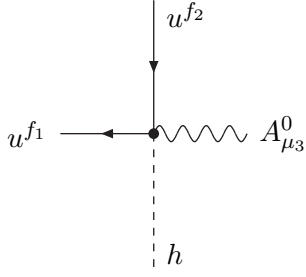
$$+\frac{iv}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} + P_R C_{f_1 f_2}^{d\varphi} \right)$$



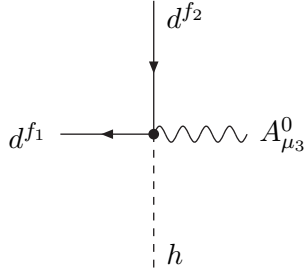
$$+\frac{v}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} - P_R C_{f_1 f_2}^{d\varphi} \right) - \left( \not{p}_3 P_R - \not{p}_4 P_R \right) C_{f_1 f_2}^{\varphi d} \\ - \left( \not{p}_3 P_L - \not{p}_4 P_L \right) C_{f_1 f_2}^{\varphi q^1} - \left( \not{p}_3 P_L - \not{p}_4 P_L \right) C_{f_1 f_2}^{\varphi q^3}$$



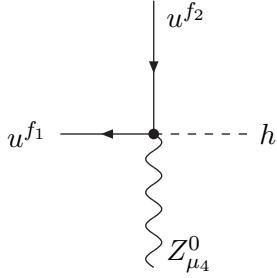
$$+\frac{3iv}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} + P_R C_{f_1 f_2}^{d\varphi} \right)$$



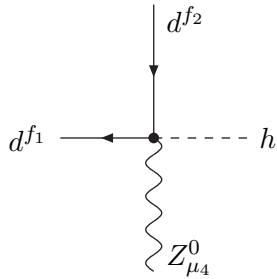
$$\begin{aligned}
& -\frac{\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{uB*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{uB} \sigma^{\mu_3 \nu} P_R) \\
& -\frac{\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{uW*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{uW} \sigma^{\mu_3 \nu} P_R)
\end{aligned}$$



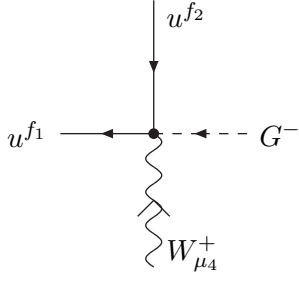
$$\begin{aligned}
& -\frac{\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{dB*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{dB} \sigma^{\mu_3 \nu} P_R) \\
& +\frac{\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{dW*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{dW} \sigma^{\mu_3 \nu} P_R)
\end{aligned}$$



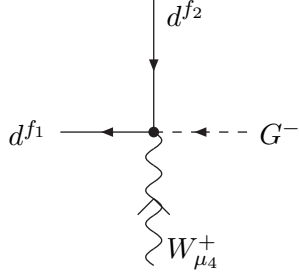
$$\begin{aligned}
& +iv\sqrt{\bar{g}^2 + \bar{g}'^2} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 1} \gamma^{\mu_4} P_L \\
& -iv\sqrt{\bar{g}^2 + \bar{g}'^2} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 3} \gamma^{\mu_4} P_L + iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi u} \gamma^{\mu_4} P_R \\
& +\frac{\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{uB*} \sigma^{\mu_4 \nu} P_L + C_{f_1 f_2}^{uB} \sigma^{\mu_4 \nu} P_R) \\
& -\frac{\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{uW*} \sigma^{\mu_4 \nu} P_L + C_{f_1 f_2}^{uW} \sigma^{\mu_4 \nu} P_R)
\end{aligned}$$



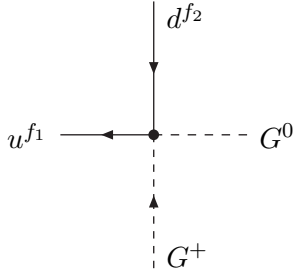
$$\begin{aligned}
& +\frac{\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{dB*} \sigma^{\mu_4 \nu} P_L + C_{f_1 f_2}^{dB} \sigma^{\mu_4 \nu} P_R) \\
& +\frac{\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{dW*} \sigma^{\mu_4 \nu} P_L + C_{f_1 f_2}^{dW} \sigma^{\mu_4 \nu} P_R) \\
& +iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi d} \gamma^{\mu_4} P_R \\
& +iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi q 1} \gamma^{\mu_4} P_L + iv\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi q 3} \gamma^{\mu_4} P_L
\end{aligned}$$



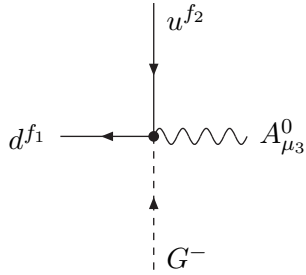
$$-i\bar{g}vK_{f_1g_2}K_{f_2g_1}^*C_{g_2g_1}^{\varphi q1}\gamma^{\mu_4}P_L - i\bar{g}vC_{f_1f_2}^{\varphi u}\gamma^{\mu_4}P_R + 2\sqrt{2}p_4^\nu C_{f_1f_2}^{uW}\sigma^{\mu_4\nu}P_R$$



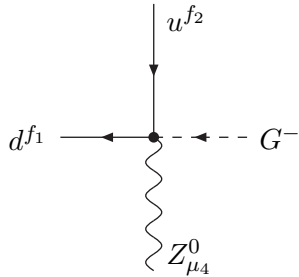
$$-2\sqrt{2}p_4^\nu C_{f_2f_1}^{dW^*}\sigma^{\mu_4\nu}P_L - i\bar{g}vC_{f_1f_2}^{\varphi d}\gamma^{\mu_4}P_R - i\bar{g}vC_{f_1f_2}^{\varphi q1}\gamma^{\mu_4}P_L$$



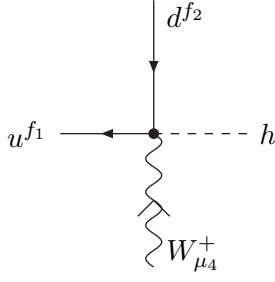
$$-\sqrt{2}K_{f_1g_1}\left(\not{p}_3P_L - \not{p}_4P_L\right)C_{g_1f_2}^{\varphi q3} + \frac{1}{\sqrt{2}}\left(\not{p}_3P_R - \not{p}_4P_R\right)C_{f_1f_2}^{\varphi ud}$$



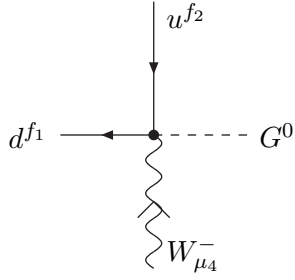
$$\begin{aligned} & -\frac{2\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}}p_3^\nu K_{f_2g_1}^*\sigma^{\mu_3\nu}P_L C_{g_1f_1}^{dB*} - \frac{2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}}p_3^\nu K_{f_2g_1}^*\sigma^{\mu_3\nu}P_L C_{g_1f_1}^{dW*} \\ & -\frac{i\sqrt{2}\bar{g}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}}K_{f_2g_1}^*C_{f_1g_1}^{\varphi q3}\gamma^{\mu_3}P_L - \frac{i\bar{g}\bar{g}'v}{\sqrt{2}\sqrt{\bar{g}^2 + \bar{g}'^2}}C_{f_2f_1}^{\varphi ud*}\gamma^{\mu_3}P_R \\ & +\frac{2\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}}p_3^\nu K_{g_1f_1}^*C_{g_1f_2}^{uB}\sigma^{\mu_3\nu}P_R - \frac{2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}}p_3^\nu K_{g_1f_1}^*C_{g_1f_2}^{uW}\sigma^{\mu_3\nu}P_R \end{aligned}$$



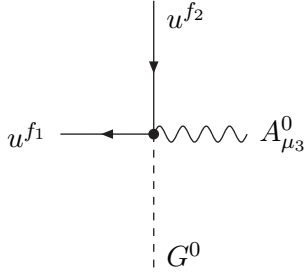
$$\begin{aligned} & +\frac{2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}}p_4^\nu K_{f_2g_1}^*\sigma^{\mu_4\nu}P_L C_{g_1f_1}^{dB*} - \frac{2\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}}p_4^\nu K_{f_2g_1}^*\sigma^{\mu_4\nu}P_L C_{g_1f_1}^{dW*} \\ & +\frac{i\sqrt{2}\bar{g}'^2v}{\sqrt{\bar{g}^2 + \bar{g}'^2}}K_{f_2g_1}^*C_{f_1g_1}^{\varphi q3}\gamma^{\mu_4}P_L - \frac{i\bar{g}^2v}{\sqrt{2}\sqrt{\bar{g}^2 + \bar{g}'^2}}C_{f_2f_1}^{\varphi ud*}\gamma^{\mu_4}P_R \\ & -\frac{2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}}p_4^\nu K_{g_1f_1}^*C_{g_1f_2}^{uB}\sigma^{\mu_4\nu}P_R - \frac{2\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}}p_4^\nu K_{g_1f_1}^*C_{g_1f_2}^{uW}\sigma^{\mu_4\nu}P_R \end{aligned}$$



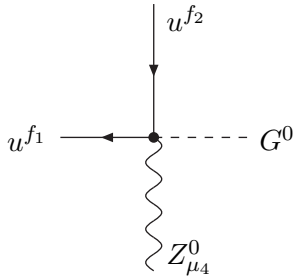
$$-2p_4^\nu K_{f_1 g_1} C_{g_1 f_2}^{dW} \sigma^{\mu_4 \nu} P_R - i\sqrt{2}\bar{g}v K_{f_1 g_1} C_{g_1 f_2}^{\varphi q^3} \gamma^{\mu_4} P_L \\ - \frac{i\bar{g}v}{\sqrt{2}} C_{f_1 f_2}^{\varphi ud} \gamma^{\mu_4} P_R - 2p_4^\nu K_{g_1 f_2} \sigma^{\mu_4 \nu} P_L C_{g_1 f_1}^{uW^*}$$



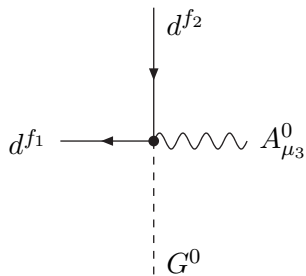
$$+2ip_4^\nu K_{f_2 g_1}^* \sigma^{\mu_4 \nu} P_L C_{g_1 f_1}^{dW^*} - \frac{\bar{g}v}{\sqrt{2}} C_{f_2 f_1}^{\varphi ud^*} \gamma^{\mu_4} P_R + 2ip_4^\nu K_{g_1 f_1}^* C_{g_1 f_2}^{uW} \sigma^{\mu_4 \nu} P_R$$



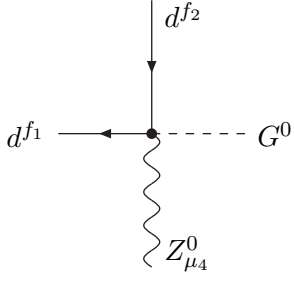
$$- \frac{i\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{uB^*} \sigma^{\mu_3 \nu} P_L - C_{f_1 f_2}^{uB} \sigma^{\mu_3 \nu} P_R) \\ - \frac{i\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{uW^*} \sigma^{\mu_3 \nu} P_L - C_{f_1 f_2}^{uW} \sigma^{\mu_3 \nu} P_R)$$



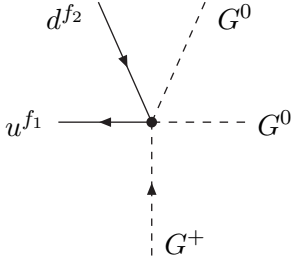
$$+ \frac{i\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{uB^*} \sigma^{\mu_4 \nu} P_L - C_{f_1 f_2}^{uB} \sigma^{\mu_4 \nu} P_R) \\ - \frac{i\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_4^\nu (C_{f_2 f_1}^{uW^*} \sigma^{\mu_4 \nu} P_L - C_{f_1 f_2}^{uW} \sigma^{\mu_4 \nu} P_R)$$



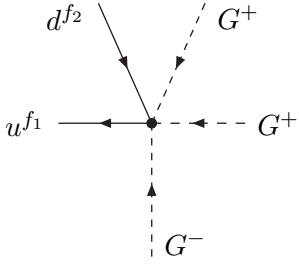
$$+ \frac{i\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{dB^*} \sigma^{\mu_3 \nu} P_L - C_{f_1 f_2}^{dB} \sigma^{\mu_3 \nu} P_R) \\ - \frac{i\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_3^\nu (C_{f_2 f_1}^{dW^*} \sigma^{\mu_3 \nu} P_L - C_{f_1 f_2}^{dW} \sigma^{\mu_3 \nu} P_R)$$



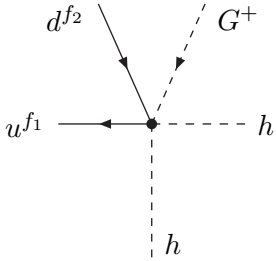
$$-\frac{i\sqrt{2}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}p_4^\nu \left( C_{f_2f_1}^{dB*}\sigma^{\mu_4\nu}P_L - C_{f_1f_2}^{dB}\sigma^{\mu_4\nu}P_R \right) \\ -\frac{i\sqrt{2}\bar{g}}{\sqrt{\bar{g}^2+\bar{g}'^2}}p_4^\nu \left( C_{f_2f_1}^{dW*}\sigma^{\mu_4\nu}P_L - C_{f_1f_2}^{dW}\sigma^{\mu_4\nu}P_R \right)$$



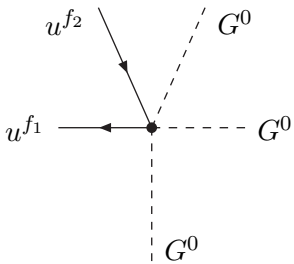
$$+iP_RK_{f_1g_1}C_{g_1f_2}^{d\varphi} - iP_LK_{g_1f_2}C_{g_1f_1}^{u\varphi*}$$



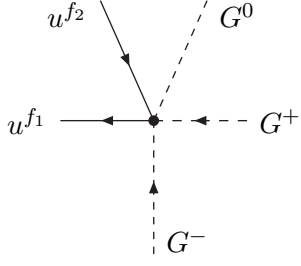
$$+2iP_RK_{f_1g_1}C_{g_1f_2}^{d\varphi} - 2iP_LK_{g_1f_2}C_{g_1f_1}^{u\varphi*}$$



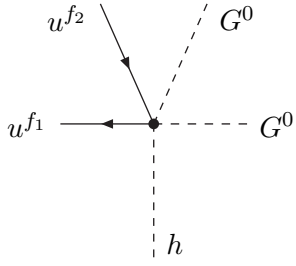
$$+iP_RK_{f_1g_1}C_{g_1f_2}^{d\varphi} - iP_LK_{g_1f_2}C_{g_1f_1}^{u\varphi*}$$



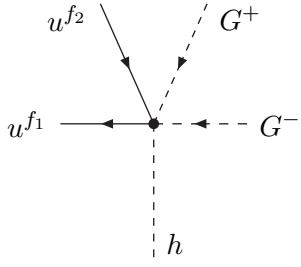
$$-\frac{3}{\sqrt{2}}\left( P_LC_{f_2f_1}^{u\varphi*} - P_RC_{f_1f_2}^{u\varphi} \right)$$



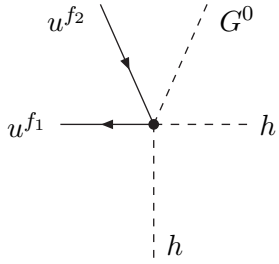
$$-\frac{1}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{u\varphi*} - P_R C_{f_1 f_2}^{u\varphi} \right)$$



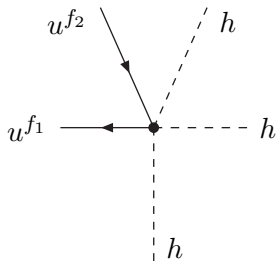
$$+\frac{i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{u\varphi*} + P_R C_{f_1 f_2}^{u\varphi} \right)$$



$$+\frac{i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{u\varphi*} + P_R C_{f_1 f_2}^{u\varphi} \right)$$

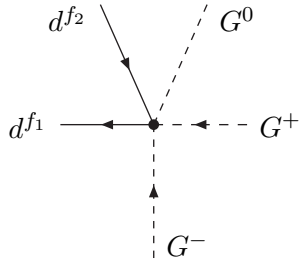


$$-\frac{1}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{u\varphi*} - P_R C_{f_1 f_2}^{u\varphi} \right)$$

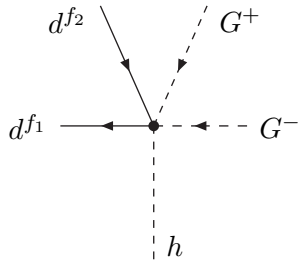


$$+\frac{3i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{u\varphi*} + P_R C_{f_1 f_2}^{u\varphi} \right)$$

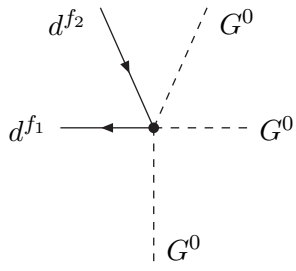




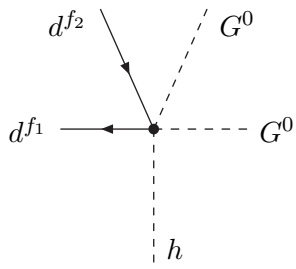
$$+\frac{1}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} - P_R C_{f_1 f_2}^{d\varphi} \right)$$



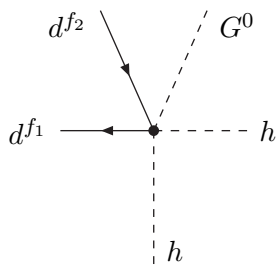
$$+\frac{i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} + P_R C_{f_1 f_2}^{d\varphi} \right)$$



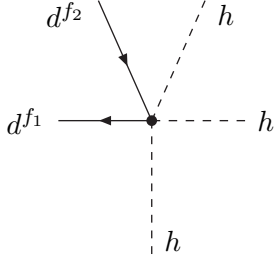
$$+\frac{3}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} - P_R C_{f_1 f_2}^{d\varphi} \right)$$



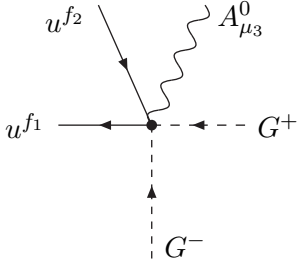
$$+\frac{i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} + P_R C_{f_1 f_2}^{d\varphi} \right)$$



$$+\frac{1}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} - P_R C_{f_1 f_2}^{d\varphi} \right)$$

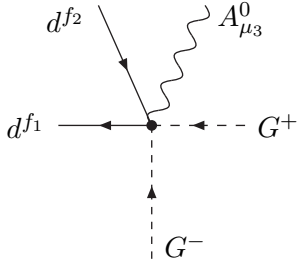


$$+\frac{3i}{\sqrt{2}} \left( P_L C_{f_2 f_1}^{d\varphi*} + P_R C_{f_1 f_2}^{d\varphi} \right)$$

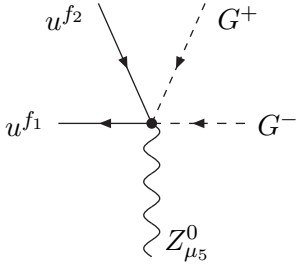


$$-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 1} \gamma^{\mu_3} P_L$$

$$-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 3} \gamma^{\mu_3} P_L - \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi u} \gamma^{\mu_3} P_R$$

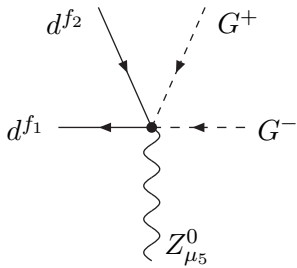


$$-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi d} \gamma^{\mu_3} P_R - \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi q 1} \gamma^{\mu_3} P_L + \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi q 3} \gamma^{\mu_3} P_L$$



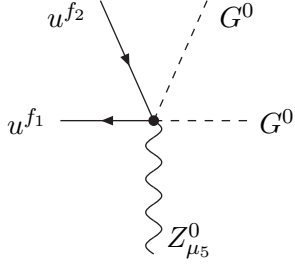
$$+\frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 1} \gamma^{\mu_5} P_L$$

$$+\frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 3} \gamma^{\mu_5} P_L + \frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi u} \gamma^{\mu_5} P_R$$

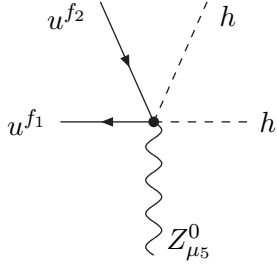


$$+\frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi d} \gamma^{\mu_5} P_R + \frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi q 1} \gamma^{\mu_5} P_L$$

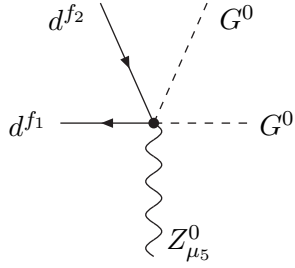
$$-\frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_1 f_2}^{\varphi q 3} \gamma^{\mu_5} P_L$$



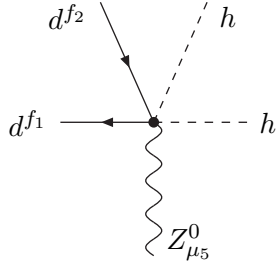
$$+i\sqrt{\bar{g}^2 + \bar{g}'^2} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 1} \gamma^{\mu_5} P_L \\ - i\sqrt{\bar{g}^2 + \bar{g}'^2} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 3} \gamma^{\mu_5} P_L + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi u} \gamma^{\mu_5} P_R$$



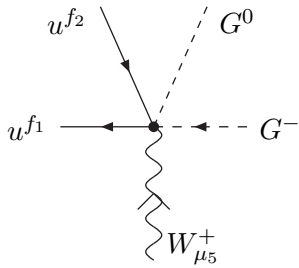
$$+i\sqrt{\bar{g}^2 + \bar{g}'^2} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 1} \gamma^{\mu_5} P_L \\ - i\sqrt{\bar{g}^2 + \bar{g}'^2} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 3} \gamma^{\mu_5} P_L + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi u} \gamma^{\mu_5} P_R$$



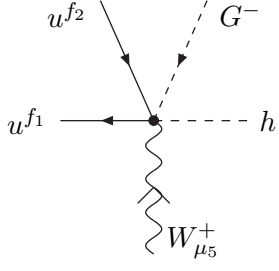
$$+i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi d} \gamma^{\mu_5} P_R + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi q 1} \gamma^{\mu_5} P_L + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi q 3} \gamma^{\mu_5} P_L$$



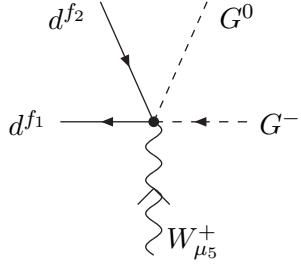
$$+i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi d} \gamma^{\mu_5} P_R + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi q 1} \gamma^{\mu_5} P_L + i\sqrt{\bar{g}^2 + \bar{g}'^2} C_{f_1 f_2}^{\varphi q 3} \gamma^{\mu_5} P_L$$



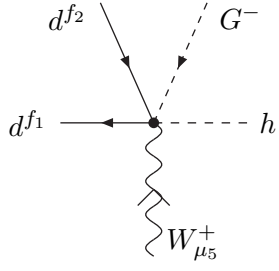
$$+\bar{g} K_{f_1 g_2} K_{f_2 g_1}^* C_{g_2 g_1}^{\varphi q 1} \gamma^{\mu_5} P_L + \bar{g} C_{f_1 f_2}^{\varphi u} \gamma^{\mu_5} P_R$$



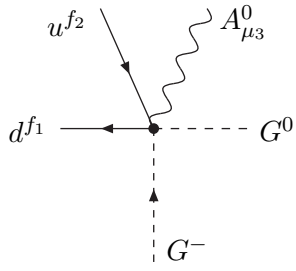
$$-i\bar{g}K_{f_1g_2}K_{f_2g_1}^*C_{g_2g_1}^{\varphi q1}\gamma^{\mu_5}P_L - i\bar{g}C_{f_1f_2}^{\varphi u}\gamma^{\mu_5}P_R$$



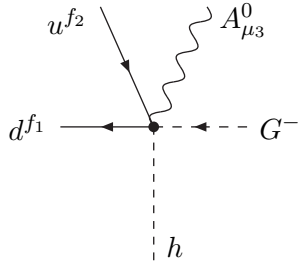
$$+\bar{g}C_{f_1f_2}^{\varphi d}\gamma^{\mu_5}P_R + \bar{g}C_{f_1f_2}^{\varphi q1}\gamma^{\mu_5}P_L$$



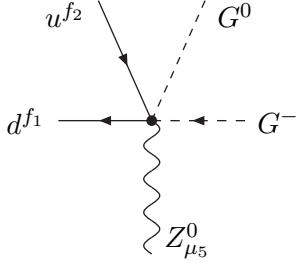
$$-i\bar{g}C_{f_1f_2}^{\varphi d}\gamma^{\mu_5}P_R - i\bar{g}C_{f_1f_2}^{\varphi q1}\gamma^{\mu_5}P_L$$



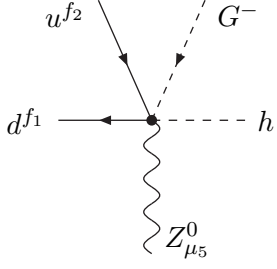
$$+\frac{\sqrt{2}\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}K_{f_2g_1}^*C_{f_1g_1}^{\varphi q3}\gamma^{\mu_3}P_L - \frac{\bar{g}\bar{g}'}{\sqrt{2}\sqrt{\bar{g}^2+\bar{g}'^2}}C_{f_2f_1}^{\varphi ud*}\gamma^{\mu_3}P_R$$



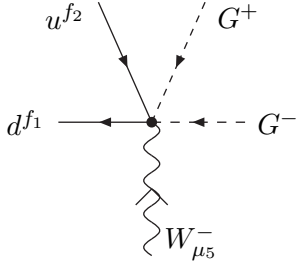
$$-\frac{i\sqrt{2}\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}K_{f_2g_1}^*C_{f_1g_1}^{\varphi q3}\gamma^{\mu_3}P_L - \frac{i\bar{g}\bar{g}'}{\sqrt{2}\sqrt{\bar{g}^2+\bar{g}'^2}}C_{f_2f_1}^{\varphi ud*}\gamma^{\mu_3}P_R$$



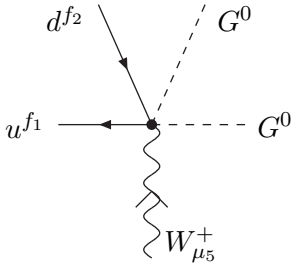
$$-\frac{\sqrt{2}\bar{g}'^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_2 g_1}^* C_{f_1 g_1}^{\varphi q 3} \gamma^{\mu_5} P_L - \frac{\bar{g}^2}{\sqrt{2}\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_2 f_1}^{\varphi u d*} \gamma^{\mu_5} P_R$$



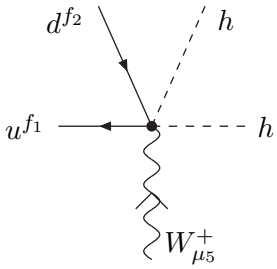
$$+\frac{i\sqrt{2}\bar{g}'^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_2 g_1}^* C_{f_1 g_1}^{\varphi q 3} \gamma^{\mu_5} P_L - \frac{i\bar{g}^2}{\sqrt{2}\sqrt{\bar{g}^2 + \bar{g}'^2}} C_{f_2 f_1}^{\varphi u d*} \gamma^{\mu_5} P_R$$



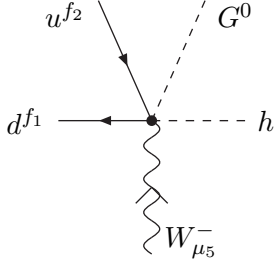
$$-i\sqrt{2}\bar{g} K_{f_2 g_1}^* C_{f_1 g_1}^{\varphi q 3} \gamma^{\mu_5} P_L$$



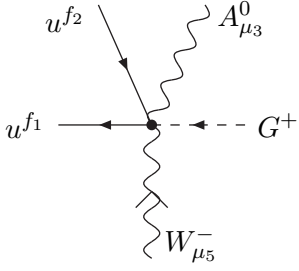
$$-i\sqrt{2}\bar{g} K_{f_1 g_1} C_{g_1 f_2}^{\varphi q 3} \gamma^{\mu_5} P_L + \frac{i\bar{g}}{\sqrt{2}} C_{f_1 f_2}^{\varphi u d} \gamma^{\mu_5} P_R$$



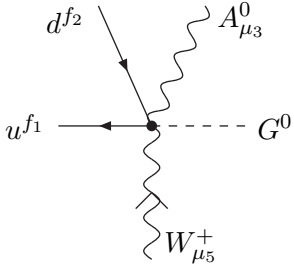
$$-i\sqrt{2}\bar{g} K_{f_1 g_1} C_{g_1 f_2}^{\varphi q 3} \gamma^{\mu_5} P_L - \frac{i\bar{g}}{\sqrt{2}} C_{f_1 f_2}^{\varphi u d} \gamma^{\mu_5} P_R$$



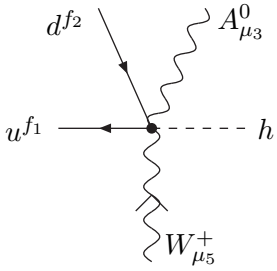
$$-\frac{\bar{g}}{\sqrt{2}}C_{f_2f_1}^{\varphi ud*}\gamma^{\mu_5}P_R$$



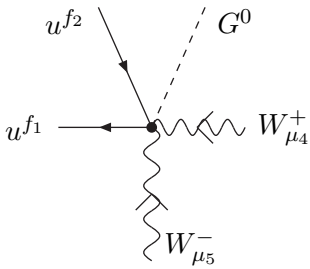
$$-\frac{2\sqrt{2}\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}\sigma^{\mu_3\mu_5}P_L C_{f_2f_1}^{uW*}$$



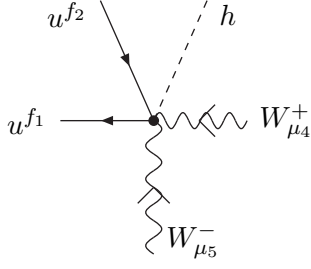
$$-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}K_{f_1g_1}\sigma^{\mu_3\mu_5}P_R C_{g_1f_2}^{dW}-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}K_{g_1f_2}\sigma^{\mu_3\mu_5}P_L C_{g_1f_1}^{uW*}$$



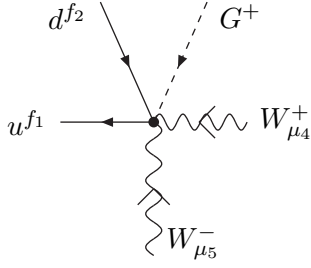
$$-\frac{2\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}K_{f_1g_1}\sigma^{\mu_3\mu_5}P_R C_{g_1f_2}^{dW}-\frac{2\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}K_{g_1f_2}\sigma^{\mu_3\mu_5}P_L C_{g_1f_1}^{uW*}$$



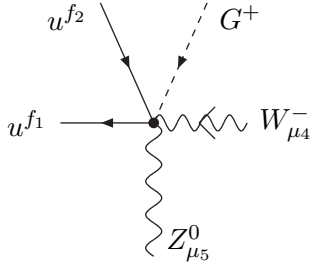
$$-i\sqrt{2}\bar{g}\left(\sigma^{\mu_4\mu_5}P_L C_{f_2f_1}^{uW*}-C_{f_1f_2}^{uW}\sigma^{\mu_4\mu_5}P_R\right)$$



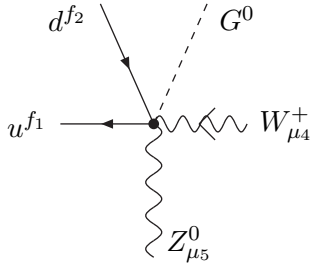
$$-\sqrt{2}\bar{g} \left( \sigma^{\mu_4\mu_5} P_L C_{f_2 f_1}^{uW*} + C_{f_1 f_2}^{uW} \sigma^{\mu_4\mu_5} P_R \right)$$



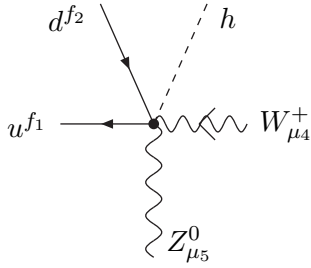
$$-2\bar{g} K_{f_1 g_1} \sigma^{\mu_4\mu_5} P_R C_{g_1 f_2}^{dW} - 2\bar{g} K_{g_1 f_2} \sigma^{\mu_4\mu_5} P_L C_{g_1 f_1}^{uW*}$$



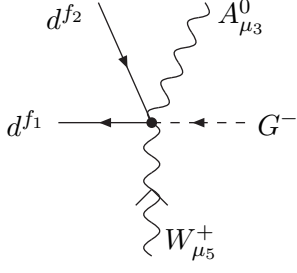
$$+\frac{2\sqrt{2}\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} \sigma^{\mu_4\mu_5} P_L C_{f_2 f_1}^{uW*}$$



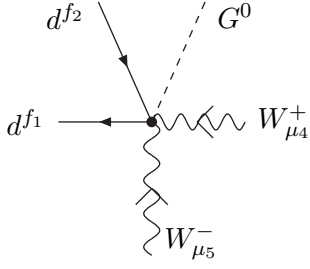
$$+\frac{2i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_1 g_1} \sigma^{\mu_4\mu_5} P_R C_{g_1 f_2}^{dW} + \frac{2i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{g_1 f_2} \sigma^{\mu_4\mu_5} P_L C_{g_1 f_1}^{uW*}$$



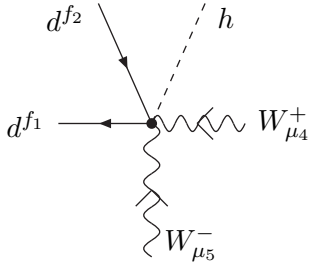
$$+\frac{2\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{f_1 g_1} \sigma^{\mu_4\mu_5} P_R C_{g_1 f_2}^{dW} + \frac{2\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} K_{g_1 f_2} \sigma^{\mu_4\mu_5} P_L C_{g_1 f_1}^{uW*}$$



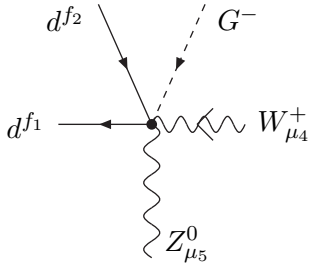
$$-\frac{2\sqrt{2}\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}}\sigma^{\mu_3\mu_5}P_L C_{f_2f_1}^{dW*}$$



$$-i\sqrt{2}\bar{g}\left(\sigma^{\mu_4\mu_5}P_L C_{f_2f_1}^{dW*} - C_{f_1f_2}^{dW}\sigma^{\mu_4\mu_5}P_R\right)$$

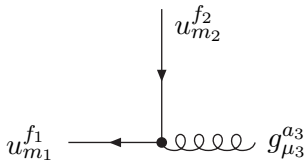


$$+\sqrt{2}\bar{g}\left(\sigma^{\mu_4\mu_5}P_L C_{f_2f_1}^{dW*} + C_{f_1f_2}^{dW}\sigma^{\mu_4\mu_5}P_R\right)$$



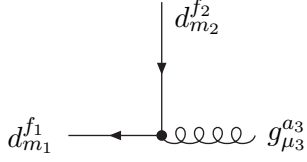
$$+\frac{2\sqrt{2}\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}}\sigma^{\mu_4\mu_5}P_L C_{f_2f_1}^{dW*}$$

## A.5 Quark-gluon vertices

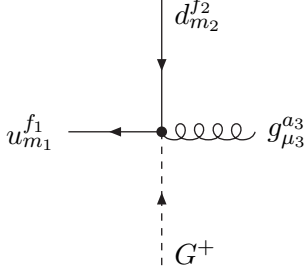


$$-i\bar{g}_s\delta_{f_1f_2}\mathcal{T}_{m_1m_2}^{a_3}\gamma^{\mu_3} - \sqrt{2}vp_3^\nu\mathcal{T}_{m_1m_2}^{a_3}\left(C_{f_2f_1}^{uG*}\sigma^{\mu_3\nu}P_L + C_{f_1f_2}^{uG}\sigma^{\mu_3\nu}P_R\right)$$

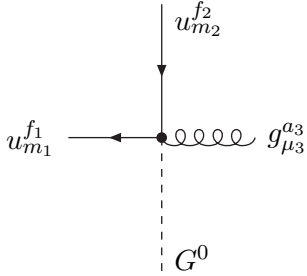




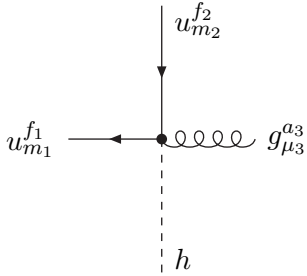
$$-i\bar{g}_s\delta_{f_1f_2}\mathcal{T}_{m_1m_2}^{a_3}\gamma^{\mu_3}-\sqrt{2}vp_3^\nu\mathcal{T}_{m_1m_2}^{a_3}\left(C_{f_2f_1}^{dG*}\sigma^{\mu_3\nu}P_L+C_{f_1f_2}^{dG}\sigma^{\mu_3\nu}P_R\right)$$



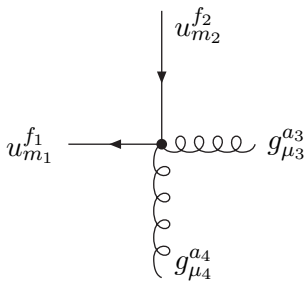
$$-2p_3^\nu\mathcal{T}_{m_1m_2}^{a_3}K_{f_1g_1}C_{g_1f_2}^{dG}\sigma^{\mu_3\nu}P_R+2p_3^\nu\mathcal{T}_{m_1m_2}^{a_3}K_{g_1f_2}\sigma^{\mu_3\nu}P_LC_{g_1f_1}^{uG*}$$



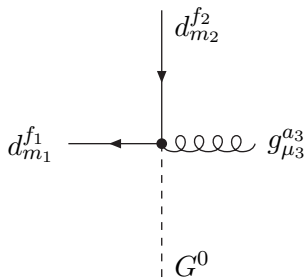
$$-i\sqrt{2}p_3^\nu\mathcal{T}_{m_1m_2}^{a_3}\left(C_{f_2f_1}^{uG*}\sigma^{\mu_3\nu}P_L-C_{f_1f_2}^{uG}\sigma^{\mu_3\nu}P_R\right)$$



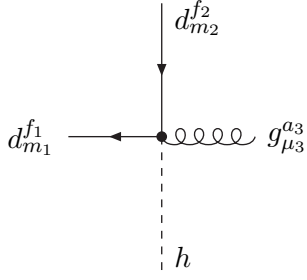
$$-\sqrt{2}p_3^\nu\mathcal{T}_{m_1m_2}^{a_3}\left(C_{f_2f_1}^{uG*}\sigma^{\mu_3\nu}P_L+C_{f_1f_2}^{uG}\sigma^{\mu_3\nu}P_R\right)$$



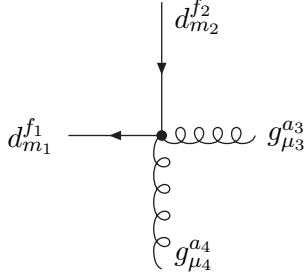
$$-i\sqrt{2}v\bar{g}_sf_{a_3a_4b_1}\mathcal{T}_{m_1m_2}^{b_1}\left(\sigma^{\mu_3\mu_4}P_LC_{f_2f_1}^{uG*}+C_{f_1f_2}^{uG}\sigma^{\mu_3\mu_4}P_R\right)$$



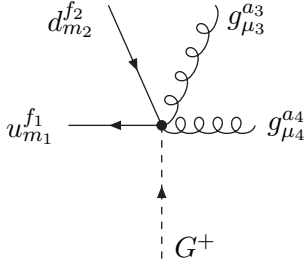
$$+i\sqrt{2}p_3^\nu\mathcal{T}_{m_1m_2}^{a_3}\left(C_{f_2f_1}^{dG*}\sigma^{\mu_3\nu}P_L-C_{f_1f_2}^{dG}\sigma^{\mu_3\nu}P_R\right)$$



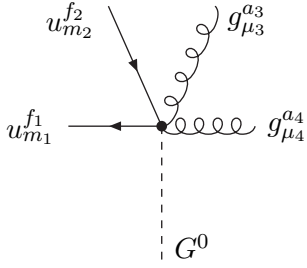
$$-\sqrt{2}p_3^\nu \mathcal{T}_{m_1 m_2}^{a_3} \left( C_{f_2 f_1}^{dG*} \sigma^{\mu_3 \nu} P_L + C_{f_1 f_2}^{dG} \sigma^{\mu_3 \nu} P_R \right)$$



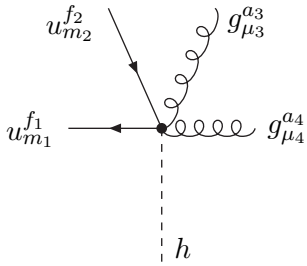
$$-i\sqrt{2}v\bar{g}_s f_{a_3 a_4 b_1} \mathcal{T}_{m_1 m_2}^{b_1} \left( \sigma^{\mu_3 \mu_4} P_L C_{f_2 f_1}^{dG*} + C_{f_1 f_2}^{dG} \sigma^{\mu_3 \mu_4} P_R \right)$$



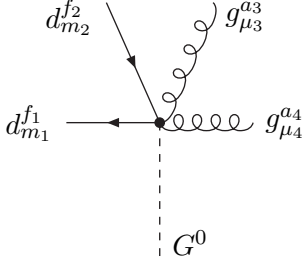
$$-2i\bar{g}_s f_{a_3 a_4 b_1} K_{f_1 g_1} \mathcal{T}_{m_1 m_2}^{b_1} \sigma^{\mu_3 \mu_4} P_R C_{g_1 f_2}^{dG} + 2i\bar{g}_s f_{a_3 a_4 b_1} K_{g_1 f_2} \mathcal{T}_{m_1 m_2}^{b_1} \sigma^{\mu_3 \mu_4} P_L C_{g_1 f_1}^{uG*}$$



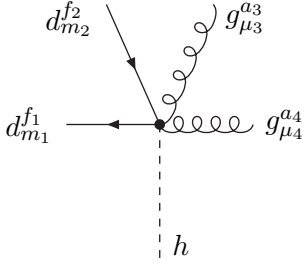
$$+\sqrt{2}\bar{g}_s f_{a_3 a_4 b_1} \mathcal{T}_{m_1 m_2}^{b_1} \left( \sigma^{\mu_3 \mu_4} P_L C_{f_2 f_1}^{uG*} - C_{f_1 f_2}^{uG} \sigma^{\mu_3 \mu_4} P_R \right)$$



$$-i\sqrt{2}\bar{g}_s f_{a_3 a_4 b_1} \mathcal{T}_{m_1 m_2}^{b_1} \left( \sigma^{\mu_3 \mu_4} P_L C_{f_2 f_1}^{uG*} + C_{f_1 f_2}^{uG} \sigma^{\mu_3 \mu_4} P_R \right)$$

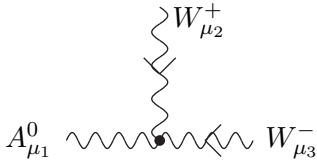


$$-\sqrt{2}\bar{g}_s f_{a_3 a_4 b_1} \mathcal{T}_{m_1 m_2}^{b_1} \left( \sigma^{\mu_3 \mu_4} P_L C_{f_2 f_1}^{dG*} - C_{f_1 f_2}^{dG} \sigma^{\mu_3 \mu_4} P_R \right)$$

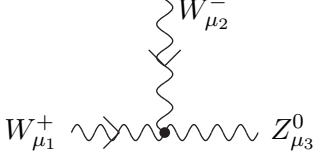


$$-i\sqrt{2}\bar{g}_s f_{a_3 a_4 b_1} \mathcal{T}_{m_1 m_2}^{b_1} \left( \sigma^{\mu_3 \mu_4} P_L C_{f_2 f_1}^{dG*} + C_{f_1 f_2}^{dG} \sigma^{\mu_3 \mu_4} P_R \right)$$

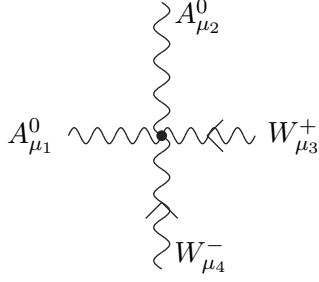
## A.6 Gauge self interaction vertices



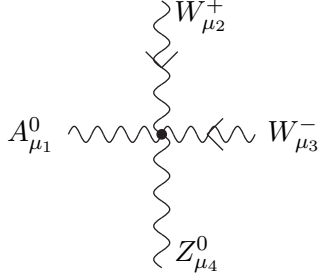
$$\begin{aligned} & + \frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} (\eta_{\mu_1 \mu_2} p_1^{\mu_3} - \eta_{\mu_1 \mu_2} p_2^{\mu_3} - \eta_{\mu_1 \mu_3} p_1^{\mu_2} \\ & + \eta_{\mu_1 \mu_3} p_3^{\mu_2} + \eta_{\mu_2 \mu_3} p_2^{\mu_1} - \eta_{\mu_2 \mu_3} p_3^{\mu_1}) \\ & + \frac{i\bar{g}^2 v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi WB} \left( \bar{g}^2 \eta_{\mu_1 \mu_2} p_1^{\mu_3} - \bar{g}^2 \eta_{\mu_1 \mu_3} p_1^{\mu_2} \right. \\ & + \bar{g}'^2 \eta_{\mu_1 \mu_2} p_2^{\mu_3} - \bar{g}'^2 \eta_{\mu_1 \mu_3} p_3^{\mu_2} - \bar{g}'^2 \eta_{\mu_2 \mu_3} p_2^{\mu_1} + \bar{g}'^2 \eta_{\mu_2 \mu_3} p_3^{\mu_1} \Big) \\ & - \frac{2i\bar{g}\bar{g}' v^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}} (p_1^{\alpha_1} + p_2^{\alpha_1} + p_3^{\alpha_1}) \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1} \\ & + \frac{i\bar{g}^2 v^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W} B} p_1^{\alpha_1} \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1} \\ & - \frac{6i\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^W (p_1 \cdot p_2 \eta_{\mu_1 \mu_3} p_3^{\mu_2} - p_1 \cdot p_2 \eta_{\mu_2 \mu_3} p_3^{\mu_1} \\ & - p_1 \cdot p_3 \eta_{\mu_1 \mu_2} p_2^{\mu_3} + p_1 \cdot p_3 \eta_{\mu_2 \mu_3} p_2^{\mu_1} \\ & + p_1^{\mu_3} (p_2 \cdot p_3 \eta_{\mu_1 \mu_2} - p_2^{\mu_1} p_3^{\mu_2}) + p_1^{\mu_2} (p_2^{\mu_3} p_3^{\mu_1} - p_2 \cdot p_3 \eta_{\mu_1 \mu_3})) \\ & - \frac{2i\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\widetilde{W}} \left( p_1 \cdot p_2 p_3^{\alpha_1} \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1} + p_1 \cdot p_3 p_2^{\alpha_1} \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1} \right. \\ & + p_2 \cdot p_3 p_1^{\alpha_1} \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1} + \eta_{\mu_1 \mu_2} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_3 \alpha_1 \beta_1 \gamma_1} \\ & + \eta_{\mu_1 \mu_3} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_2 \alpha_1 \beta_1 \gamma_1} + \eta_{\mu_2 \mu_3} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_1 \alpha_1 \beta_1 \gamma_1} \\ & + p_1^{\alpha_1} p_3^{\beta_1} p_2^{\mu_1} (-\epsilon_{\mu_2 \mu_3 \alpha_1 \beta_1}) + p_3^{\beta_1} (p_2^{\alpha_1} p_1^{\mu_3} + p_1^{\alpha_1} p_2^{\mu_3}) \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1} \\ & \left. - p_1^{\alpha_1} p_2^{\beta_1} p_3^{\mu_1} \epsilon_{\mu_2 \mu_3 \alpha_1 \beta_1} + \epsilon_{\mu_1 \mu_3 \alpha_1 \beta_1} \left( p_2^{\alpha_1} p_3^{\beta_1} p_1^{\mu_2} - p_1^{\alpha_1} p_2^{\beta_1} p_3^{\mu_2} \right) \right) \end{aligned}$$



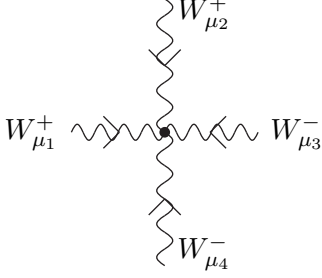
$$\begin{aligned}
& + \frac{i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} (\eta_{\mu_1\mu_2} p_1^{\mu_3} - \eta_{\mu_1\mu_2} p_2^{\mu_3} - \eta_{\mu_1\mu_3} p_1^{\mu_2} \\
& + \eta_{\mu_1\mu_3} p_3^{\mu_2} + \eta_{\mu_2\mu_3} p_2^{\mu_1} - \eta_{\mu_2\mu_3} p_3^{\mu_1}) \\
& + \frac{i\bar{g}\bar{g}'v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi WB} \left( \bar{g}^2 \eta_{\mu_1\mu_3} (-p_3^{\mu_2}) + \bar{g}'^2 \eta_{\mu_2\mu_3} p_3^{\mu_1} \right. \\
& + \bar{g}'^2 \eta_{\mu_1\mu_2} p_1^{\mu_3} - \bar{g}'^2 \eta_{\mu_1\mu_2} p_2^{\mu_3} - \bar{g}'^2 \eta_{\mu_1\mu_3} p_1^{\mu_2} + \bar{g}'^2 \eta_{\mu_2\mu_3} p_2^{\mu_1} \Big) \\
& - \frac{2i\bar{g}^2 v^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}} (p_1^{\alpha_1} + p_2^{\alpha_1} + p_3^{\alpha_1}) \epsilon_{\mu_1\mu_2\mu_3\alpha_1} \\
& - \frac{i\bar{g}\bar{g}'v^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W} B} p_3^{\alpha_1} \epsilon_{\mu_1\mu_2\mu_3\alpha_1} \\
& - \frac{6i\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^W (p_1 \cdot p_2 \eta_{\mu_1\mu_3} p_3^{\mu_2} - p_1 \cdot p_2 \eta_{\mu_2\mu_3} p_3^{\mu_1} \\
& - p_1 \cdot p_3 \eta_{\mu_1\mu_2} p_2^{\mu_3} + p_1 \cdot p_3 \eta_{\mu_2\mu_3} p_2^{\mu_1} \\
& + p_1^{\mu_3} (p_2 \cdot p_3 \eta_{\mu_1\mu_2} - p_2^{\mu_1} p_3^{\mu_2}) + p_1^{\mu_2} (p_2^{\mu_3} p_3^{\mu_1} - p_2 \cdot p_3 \eta_{\mu_1\mu_3})) \\
& - \frac{2i\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\widetilde{W}} \left( p_1 \cdot p_2 p_3^{\alpha_1} \epsilon_{\mu_1\mu_2\mu_3\alpha_1} + p_1 \cdot p_3 p_2^{\alpha_1} \epsilon_{\mu_1\mu_2\mu_3\alpha_1} \right. \\
& + p_2 \cdot p_3 p_1^{\alpha_1} \epsilon_{\mu_1\mu_2\mu_3\alpha_1} + \eta_{\mu_1\mu_2} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_3\alpha_1\beta_1\gamma_1} \\
& + \eta_{\mu_1\mu_3} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_2\alpha_1\beta_1\gamma_1} + \eta_{\mu_2\mu_3} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_1\alpha_1\beta_1\gamma_1} \\
& + p_1^{\alpha_1} p_3^{\beta_1} p_2^{\mu_1} (-\epsilon_{\mu_2\mu_3\alpha_1\beta_1}) + p_3^{\beta_1} (p_2^{\alpha_1} p_1^{\mu_3} + p_1^{\alpha_1} p_2^{\mu_3}) \epsilon_{\mu_1\mu_2\alpha_1\beta_1} \\
& \left. - p_1^{\alpha_1} p_2^{\beta_1} p_3^{\mu_1} \epsilon_{\mu_2\mu_3\alpha_1\beta_1} + \epsilon_{\mu_1\mu_3\alpha_1\beta_1} \left( p_2^{\alpha_1} p_3^{\beta_1} p_1^{\mu_2} - p_1^{\alpha_1} p_2^{\beta_1} p_3^{\mu_2} \right) \right)
\end{aligned}$$



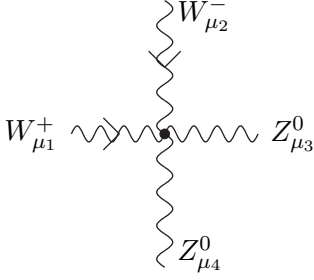
$$\begin{aligned}
& + \frac{i\bar{g}^2\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) \\
& - \frac{2i\bar{g}^3\bar{g}'^3v^2}{(\bar{g}^2 + \bar{g}'^2)^2} (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) C^{\varphi WB} \\
& - \frac{6i\bar{g}\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^W (\eta_{\mu_1\mu_2}p_1^{\mu_4}p_4^{\mu_3} + \eta_{\mu_1\mu_2}p_2^{\mu_4}p_4^{\mu_3} + \eta_{\mu_1\mu_3}p_1^{\mu_4}p_3^{\mu_2} \\
& - \eta_{\mu_1\mu_3}p_2^{\mu_4}p_3^{\mu_2} - \eta_{\mu_1\mu_3}p_1^{\mu_2}p_3^{\mu_4} - \eta_{\mu_1\mu_3}p_1^{\mu_4}p_4^{\mu_2} - \eta_{\mu_1\mu_4}p_1^{\mu_2}p_4^{\mu_3} \\
& - \eta_{\mu_2\mu_3}p_1^{\mu_4}p_3^{\mu_1} + \eta_{\mu_2\mu_3}p_2^{\mu_4}p_3^{\mu_1} - \eta_{\mu_2\mu_3}p_2^{\mu_1}p_3^{\mu_4} - \eta_{\mu_2\mu_3}p_2^{\mu_4}p_4^{\mu_1} \\
& - \eta_{\mu_2\mu_4}p_2^{\mu_1}p_4^{\mu_3} + p_1^{\mu_3}(\eta_{\mu_1\mu_2}p_3^{\mu_4} - \eta_{\mu_1\mu_4}p_3^{\mu_2} + \eta_{\mu_1\mu_4}p_4^{\mu_2} - \eta_{\mu_2\mu_4}p_4^{\mu_1}) \\
& + p_2^{\mu_3}(\eta_{\mu_1\mu_2}p_3^{\mu_4} - \eta_{\mu_1\mu_4}p_4^{\mu_2} + \eta_{\mu_2\mu_4}(p_4^{\mu_1} - p_3^{\mu_1})) + \eta_{\mu_3\mu_4}p_1^{\mu_2}p_3^{\mu_1} \\
& + \eta_{\mu_3\mu_4}p_2^{\mu_1}p_3^{\mu_2} + \eta_{\mu_3\mu_4}p_1^{\mu_2}p_4^{\mu_1} + \eta_{\mu_3\mu_4}p_2^{\mu_1}p_4^{\mu_2} - p_1 \cdot p_3 \eta_{\mu_3\mu_4} \eta_{\mu_1\mu_2} \\
& - p_1 \cdot p_4 \eta_{\mu_3\mu_4} \eta_{\mu_1\mu_2} - p_2 \cdot p_3 \eta_{\mu_3\mu_4} \eta_{\mu_1\mu_2} - p_2 \cdot p_4 \eta_{\mu_3\mu_4} \eta_{\mu_1\mu_2} + p_1 \cdot p_3 \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} \\
& + p_1 \cdot p_4 \eta_{\mu_1\mu_3} \eta_{\mu_2\mu_4} + p_2 \cdot p_3 \eta_{\mu_1\mu_3} \eta_{\mu_2\mu_4} + p_2 \cdot p_4 \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3}) \\
& + \frac{2i\bar{g}\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\tilde{W}} \left( -\epsilon_{\mu_1\mu_2\mu_3\alpha_1} p_1^{\mu_4} p_3^{\alpha_1} + \epsilon_{\mu_2\mu_4\mu_3\alpha_1} p_2^{\mu_1} p_3^{\alpha_1} + \epsilon_{\mu_1\mu_2\mu_3\alpha_1} p_2^{\mu_4} p_3^{\alpha_1} \right. \\
& + \epsilon_{\mu_2\mu_4\mu_3\alpha_1} p_1^{\alpha_1} p_3^{\mu_1} + \epsilon_{\mu_2\mu_4\mu_3\alpha_1} p_2^{\alpha_1} p_3^{\mu_1} - \epsilon_{\mu_1\mu_2\mu_3\alpha_1} p_1^{\alpha_1} p_3^{\mu_4} + \epsilon_{\mu_1\mu_2\mu_3\alpha_1} p_2^{\alpha_1} p_3^{\mu_4} \\
& - \epsilon_{\mu_1\mu_2\mu_3\alpha_1} p_1^{\mu_4} p_4^{\alpha_1} - \epsilon_{\mu_2\mu_4\mu_3\alpha_1} p_2^{\mu_1} p_4^{\alpha_1} + \epsilon_{\mu_1\mu_2\mu_3\alpha_1} p_2^{\mu_4} p_4^{\alpha_1} - \epsilon_{\mu_2\mu_4\mu_3\alpha_1} p_1^{\alpha_1} p_4^{\mu_1} \\
& - \epsilon_{\mu_2\mu_4\mu_3\alpha_1} p_2^{\alpha_1} p_4^{\mu_1} + \epsilon_{\mu_1\mu_4\mu_3\alpha_1} (p_1^{\mu_2} (p_3^{\alpha_1} - p_4^{\alpha_1}) + (p_1^{\alpha_1} + p_2^{\alpha_1}) (p_3^{\mu_2} - p_4^{\mu_2})) \\
& + \epsilon_{\mu_1\mu_2\mu_4\alpha_1} (-p_1^{\mu_3} (p_3^{\alpha_1} + p_4^{\alpha_1}) + p_2^{\mu_3} (p_3^{\alpha_1} + p_4^{\alpha_1}) + (p_2^{\alpha_1} - p_1^{\alpha_1}) p_4^{\mu_3}) \\
& - \epsilon_{\mu_4\mu_3\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_2} - \epsilon_{\mu_4\mu_3\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_2} + \epsilon_{\mu_4\mu_3\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_2} \\
& + \epsilon_{\mu_4\mu_3\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_2} + \epsilon_{\mu_2\mu_4\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_3} + \epsilon_{\mu_2\mu_4\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_3} \\
& + \epsilon_{\mu_2\mu_4\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_3} + \epsilon_{\mu_2\mu_3\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_4} + \epsilon_{\mu_2\mu_3\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_4} \\
& + \epsilon_{\mu_2\mu_3\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_4} + \epsilon_{\mu_1\mu_4\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_2\mu_3} + \epsilon_{\mu_1\mu_4\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_2\mu_3} \\
& + \epsilon_{\mu_1\mu_4\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_2\mu_3} + \epsilon_{\mu_1\mu_3\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_2\mu_4} + \epsilon_{\mu_1\mu_3\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_2\mu_4} \\
& + \epsilon_{\mu_1\mu_3\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_2\mu_4} - \epsilon_{\mu_1\mu_2\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_3\mu_4} + \epsilon_{\mu_1\mu_2\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_3\mu_4} \\
& - \epsilon_{\mu_1\mu_2\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_3\mu_4} + \epsilon_{\mu_1\mu_2\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_3\mu_4} + \epsilon_{\mu_1\mu_2\mu_4\mu_3} p_1 \cdot p_3 \\
& \left. - \epsilon_{\mu_1\mu_2\mu_4\mu_3} p_1 \cdot p_4 - \epsilon_{\mu_1\mu_2\mu_4\mu_3} p_2 \cdot p_3 + \epsilon_{\mu_1\mu_2\mu_4\mu_3} p_2 \cdot p_4 \right)
\end{aligned}$$



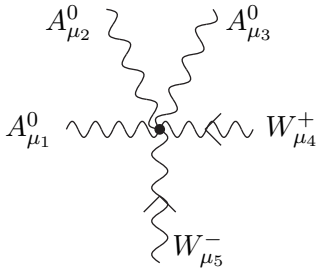
$$\begin{aligned}
& -\frac{i\bar{g}^3\bar{g}'}{\bar{g}^2+\bar{g}'^2}(2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}-\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}-\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) \\
& -\frac{i\bar{g}^2\bar{g}'^2v^2(\bar{g}'^2-\bar{g}^2)}{(\bar{g}^2+\bar{g}'^2)^2}(2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}-\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}-\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4})C^{\varphi WB} \\
& +\frac{6i\bar{g}^2\bar{g}'}{\bar{g}^2+\bar{g}'^2}C^W(\eta_{\mu_1\mu_2}p_2^{\mu_4}p_4^{\mu_3}+\eta_{\mu_1\mu_3}p_1^{\mu_2}p_2^{\mu_4}-\eta_{\mu_1\mu_3}p_1^{\mu_2}p_3^{\mu_4}+\eta_{\mu_1\mu_3}p_3^{\mu_4}p_4^{\mu_2} \\
& -\eta_{\mu_1\mu_4}p_1^{\mu_2}p_2^{\mu_3}-\eta_{\mu_1\mu_4}p_2^{\mu_3}p_4^{\mu_2}-\eta_{\mu_1\mu_4}p_3^{\mu_2}p_4^{\mu_3}-\eta_{\mu_2\mu_3}p_2^{\mu_4}p_4^{\mu_1}-\eta_{\mu_2\mu_3}p_3^{\mu_4}p_4^{\mu_1} \\
& +p_1^{\mu_4}(\eta_{\mu_1\mu_2}p_2^{\mu_3}+\eta_{\mu_1\mu_3}p_3^{\mu_2}-\eta_{\mu_2\mu_3}(p_2^{\mu_1}+p_3^{\mu_1}))+\eta_{\mu_2\mu_4}p_2^{\mu_3}p_4^{\mu_1}-\eta_{\mu_2\mu_4}p_2^{\mu_1}p_4^{\mu_3} \\
& +\eta_{\mu_2\mu_4}p_3^{\mu_1}p_4^{\mu_3}+p_1^{\mu_3}(\eta_{\mu_1\mu_2}(-p_2^{\mu_4})+\eta_{\mu_1\mu_2}p_3^{\mu_4}-\eta_{\mu_1\mu_4}p_3^{\mu_2}+\eta_{\mu_2\mu_4}p_2^{\mu_1}) \\
& +\eta_{\mu_3\mu_4}p_1^{\mu_2}p_3^{\mu_1}+\eta_{\mu_3\mu_4}p_3^{\mu_2}p_4^{\mu_1}+\eta_{\mu_3\mu_4}p_2^{\mu_1}p_4^{\mu_2}-\eta_{\mu_3\mu_4}p_3^{\mu_1}p_4^{\mu_2}-p_1\cdot p_3\eta_{\mu_3\mu_4}\eta_{\mu_1\mu_2} \\
& -p_2\cdot p_4\eta_{\mu_3\mu_4}\eta_{\mu_1\mu_2}+p_1\cdot p_2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}-p_1\cdot p_2\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}+p_1\cdot p_3\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} \\
& +p_2\cdot p_4\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}+p_3\cdot p_4\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}-p_3\cdot p_4\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}) \\
& +\frac{2i\bar{g}^2\bar{g}'}{\bar{g}^2+\bar{g}'^2}C^{\widetilde{W}}\left(\epsilon_{\mu_1\mu_3\mu_2\alpha_1}p_1^{\mu_4}p_2^{\alpha_1}-\epsilon_{\mu_3\mu_4\mu_2\alpha_1}p_4^{\mu_1}p_2^{\alpha_1}+\epsilon_{\mu_3\mu_4\alpha_1\beta_1}p_4^{\beta_1}\eta_{\mu_1\mu_2}p_2^{\alpha_1} \right. \\
& +\epsilon_{\mu_3\mu_2\alpha_1\beta_1}p_4^{\beta_1}\eta_{\mu_1\mu_4}p_2^{\alpha_1}-\epsilon_{\mu_1\mu_4\alpha_1\beta_1}p_4^{\beta_1}\eta_{\mu_2\mu_3}p_2^{\alpha_1}-\epsilon_{\mu_1\mu_3\alpha_1\beta_1}p_4^{\beta_1}\eta_{\mu_2\mu_4}p_2^{\alpha_1} \\
& -\epsilon_{\mu_1\mu_2\alpha_1\beta_1}p_4^{\beta_1}\eta_{\mu_3\mu_4}p_2^{\alpha_1}-\epsilon_{\mu_3\mu_4\mu_2\alpha_1}p_1^{\alpha_1}p_2^{\mu_1}+\epsilon_{\mu_1\mu_3\mu_2\alpha_1}p_1^{\alpha_1}p_2^{\mu_4} \\
& -\epsilon_{\mu_1\mu_3\mu_2\alpha_1}p_1^{\mu_4}p_3^{\alpha_1}+\epsilon_{\mu_3\mu_4\mu_2\alpha_1}p_1^{\alpha_1}p_3^{\mu_1}-\epsilon_{\mu_1\mu_3\mu_2\alpha_1}p_1^{\alpha_1}p_3^{\mu_4}-\epsilon_{\mu_3\mu_4\mu_2\alpha_1}p_2^{\mu_1}p_4^{\alpha_1} \\
& +\epsilon_{\mu_1\mu_3\mu_2\alpha_1}p_2^{\mu_4}p_4^{\alpha_1}+\epsilon_{\mu_3\mu_4\mu_2\alpha_1}p_3^{\mu_1}p_4^{\alpha_1}-\epsilon_{\mu_1\mu_3\mu_2\alpha_1}p_3^{\mu_4}p_4^{\alpha_1}+\epsilon_{\mu_3\mu_4\mu_2\alpha_1}p_3^{\alpha_1}p_4^{\mu_1} \\
& +\epsilon_{\mu_1\mu_3\mu_4\alpha_1}(p_1^{\mu_2}(p_2^{\alpha_1}+p_3^{\alpha_1})+p_1^{\alpha_1}p_3^{\mu_2}-p_3^{\mu_2}p_4^{\alpha_1}-p_2^{\alpha_1}p_4^{\mu_2}-p_3^{\alpha_1}p_4^{\mu_2}) \\
& +\epsilon_{\mu_1\mu_4\mu_2\alpha_1}(-p_1^{\alpha_1}p_2^{\mu_3}+p_4^{\alpha_1}p_2^{\mu_3}-p_1^{\mu_3}(p_2^{\alpha_1}+p_3^{\alpha_1})+p_2^{\alpha_1}p_4^{\mu_3}+p_3^{\alpha_1}p_4^{\mu_3}) \\
& -\epsilon_{\mu_3\mu_4\alpha_1\beta_1}p_1^{\alpha_1}p_2^{\beta_1}\eta_{\mu_1\mu_2}-\epsilon_{\mu_3\mu_4\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_1\mu_2}+\epsilon_{\mu_4\mu_2\alpha_1\beta_1}p_1^{\alpha_1}p_2^{\beta_1}\eta_{\mu_1\mu_3} \\
& +\epsilon_{\mu_4\mu_2\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_1\mu_3}-\epsilon_{\mu_4\mu_2\alpha_1\beta_1}p_3^{\alpha_1}p_4^{\beta_1}\eta_{\mu_1\mu_3}-\epsilon_{\mu_3\mu_2\alpha_1\beta_1}p_1^{\alpha_1}p_2^{\beta_1}\eta_{\mu_1\mu_4} \\
& +\epsilon_{\mu_3\mu_2\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_1\mu_4}-\epsilon_{\mu_3\mu_2\alpha_1\beta_1}p_3^{\alpha_1}p_4^{\beta_1}\eta_{\mu_1\mu_4}-\epsilon_{\mu_1\mu_4\alpha_1\beta_1}p_1^{\alpha_1}p_2^{\beta_1}\eta_{\mu_2\mu_3} \\
& -\epsilon_{\mu_1\mu_4\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_2\mu_3}-\epsilon_{\mu_1\mu_4\alpha_1\beta_1}p_3^{\alpha_1}p_4^{\beta_1}\eta_{\mu_2\mu_3}+\epsilon_{\mu_1\mu_3\alpha_1\beta_1}p_1^{\alpha_1}p_2^{\beta_1}\eta_{\mu_2\mu_4} \\
& -\epsilon_{\mu_1\mu_3\alpha_1\beta_1}p_3^{\alpha_1}p_4^{\beta_1}\eta_{\mu_2\mu_4}+\epsilon_{\mu_1\mu_2\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_3\mu_4}-\epsilon_{\mu_1\mu_2\alpha_1\beta_1}p_3^{\alpha_1}p_4^{\beta_1}\eta_{\mu_3\mu_4} \\
& \left. -\epsilon_{\mu_1\mu_3\mu_4\mu_2}p_1\cdot p_2+\epsilon_{\mu_1\mu_3\mu_4\mu_2}p_1\cdot p_3+\epsilon_{\mu_1\mu_3\mu_4\mu_2}p_2\cdot p_4-\epsilon_{\mu_1\mu_3\mu_4\mu_2}p_3\cdot p_4\right)
\end{aligned}$$



$$\begin{aligned}
& -i\bar{g}^2 (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) \\
& + 6i\bar{g}C^W (\eta_{\mu_1\mu_2}p_1^{\mu_4}p_4^{\mu_3} + \eta_{\mu_1\mu_2}p_2^{\mu_4}p_4^{\mu_3} + \eta_{\mu_1\mu_3}p_1^{\mu_4}p_3^{\mu_2} - \eta_{\mu_1\mu_3}p_2^{\mu_4}p_3^{\mu_2} - \eta_{\mu_1\mu_3}p_1^{\mu_2}p_3^{\mu_4} \\
& - \eta_{\mu_1\mu_3}p_1^{\mu_4}p_4^{\mu_2} - \eta_{\mu_1\mu_4}p_1^{\mu_2}p_4^{\mu_3} - \eta_{\mu_2\mu_3}p_1^{\mu_4}p_3^{\mu_1} + \eta_{\mu_2\mu_3}p_2^{\mu_4}p_3^{\mu_1} - \eta_{\mu_2\mu_3}p_2^{\mu_1}p_3^{\mu_4} \\
& - \eta_{\mu_2\mu_3}p_2^{\mu_4}p_4^{\mu_1} - \eta_{\mu_2\mu_4}p_2^{\mu_1}p_4^{\mu_3} + p_1^{\mu_3} (\eta_{\mu_1\mu_2}p_3^{\mu_4} - \eta_{\mu_1\mu_4}p_3^{\mu_2} + \eta_{\mu_1\mu_4}p_4^{\mu_2} - \eta_{\mu_2\mu_4}p_4^{\mu_1}) \\
& + p_2^{\mu_3} (\eta_{\mu_1\mu_2}p_3^{\mu_4} - \eta_{\mu_1\mu_4}p_4^{\mu_2} + \eta_{\mu_2\mu_4} (p_4^{\mu_1} - p_3^{\mu_1})) + \eta_{\mu_3\mu_4}p_1^{\mu_2}p_3^{\mu_1} \\
& + \eta_{\mu_3\mu_4}p_2^{\mu_1}p_3^{\mu_2} + \eta_{\mu_3\mu_4}p_1^{\mu_2}p_4^{\mu_1} + \eta_{\mu_3\mu_4}p_2^{\mu_1}p_4^{\mu_2} - p_1 \cdot p_3 \eta_{\mu_3\mu_4} \eta_{\mu_1\mu_2} \\
& - p_1 \cdot p_4 \eta_{\mu_3\mu_4} \eta_{\mu_1\mu_2} - p_2 \cdot p_3 \eta_{\mu_3\mu_4} \eta_{\mu_1\mu_2} - p_2 \cdot p_4 \eta_{\mu_3\mu_4} \eta_{\mu_1\mu_2} + p_1 \cdot p_3 \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} \\
& + p_1 \cdot p_4 \eta_{\mu_1\mu_3} \eta_{\mu_2\mu_4} + p_2 \cdot p_3 \eta_{\mu_1\mu_3} \eta_{\mu_2\mu_4} + p_2 \cdot p_4 \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3}) \\
& + 2i\bar{g}C^{\widetilde{W}} \left( -\epsilon_{\mu_1\mu_3\mu_2\alpha_1} p_1^{\mu_4} p_3^{\alpha_1} - \epsilon_{\mu_3\mu_2\mu_4\alpha_1} p_2^{\mu_1} p_3^{\alpha_1} + \epsilon_{\mu_1\mu_3\mu_2\alpha_1} p_2^{\mu_4} p_3^{\alpha_1} \right. \\
& - \epsilon_{\mu_3\mu_2\mu_4\alpha_1} p_1^{\alpha_1} p_3^{\mu_1} - \epsilon_{\mu_3\mu_2\mu_4\alpha_1} p_2^{\alpha_1} p_3^{\mu_1} - \epsilon_{\mu_1\mu_3\mu_2\alpha_1} p_1^{\alpha_1} p_3^{\mu_4} + \epsilon_{\mu_1\mu_3\mu_2\alpha_1} p_2^{\alpha_1} p_3^{\mu_4} \\
& - \epsilon_{\mu_1\mu_3\mu_2\alpha_1} p_1^{\mu_4} p_4^{\alpha_1} + \epsilon_{\mu_3\mu_2\mu_4\alpha_1} p_2^{\mu_1} p_4^{\alpha_1} + \epsilon_{\mu_1\mu_3\mu_2\alpha_1} p_2^{\mu_4} p_4^{\alpha_1} + \epsilon_{\mu_3\mu_2\mu_4\alpha_1} p_1^{\alpha_1} p_4^{\mu_1} \\
& + \epsilon_{\mu_3\mu_2\mu_4\alpha_1} p_2^{\alpha_1} p_4^{\mu_1} + \epsilon_{\mu_1\mu_3\mu_4\alpha_1} (p_1^{\mu_2} (p_3^{\alpha_1} - p_4^{\alpha_1}) + (p_1^{\alpha_1} + p_2^{\alpha_1}) (p_3^{\mu_2} - p_4^{\mu_2})) \\
& + \epsilon_{\mu_1\mu_2\mu_4\alpha_1} (p_1^{\mu_3} (p_3^{\alpha_1} + p_4^{\alpha_1}) - p_2^{\mu_3} (p_3^{\alpha_1} + p_4^{\alpha_1}) + (p_1^{\alpha_1} - p_2^{\alpha_1}) p_4^{\mu_3}) \\
& - \epsilon_{\mu_3\mu_4\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_2} - \epsilon_{\mu_3\mu_4\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_2} + \epsilon_{\mu_3\mu_4\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_2} \\
& + \epsilon_{\mu_3\mu_4\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_2} - \epsilon_{\mu_2\mu_4\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_3} - \epsilon_{\mu_2\mu_4\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_3} \\
& - \epsilon_{\mu_2\mu_4\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_3} + \epsilon_{\mu_3\mu_2\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_4} + \epsilon_{\mu_3\mu_2\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_4} \\
& + \epsilon_{\mu_3\mu_2\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_4} - \epsilon_{\mu_1\mu_4\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_2\mu_3} - \epsilon_{\mu_1\mu_4\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_2\mu_3} \\
& - \epsilon_{\mu_1\mu_4\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_2\mu_3} - \epsilon_{\mu_1\mu_3\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_2\mu_4} - \epsilon_{\mu_1\mu_3\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_2\mu_4} \\
& - \epsilon_{\mu_1\mu_3\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_2\mu_4} + \epsilon_{\mu_1\mu_2\alpha_1\beta_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_3\mu_4} - \epsilon_{\mu_1\mu_2\alpha_1\beta_1} p_2^{\alpha_1} p_3^{\beta_1} \eta_{\mu_3\mu_4} \\
& + \epsilon_{\mu_1\mu_2\alpha_1\beta_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_3\mu_4} - \epsilon_{\mu_1\mu_2\alpha_1\beta_1} p_2^{\alpha_1} p_4^{\beta_1} \eta_{\mu_3\mu_4} - \epsilon_{\mu_1\mu_3\mu_2\mu_4} p_1 \cdot p_3 \\
& \left. + \epsilon_{\mu_1\mu_3\mu_2\mu_4} p_1 \cdot p_4 + \epsilon_{\mu_1\mu_3\mu_2\mu_4} p_2 \cdot p_3 - \epsilon_{\mu_1\mu_3\mu_2\mu_4} p_2 \cdot p_4 \right)
\end{aligned}$$

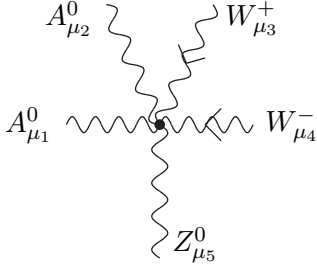


$$\begin{aligned}
& + \frac{i\bar{g}^4}{\bar{g}^2 + \bar{g}'^2} (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) \\
& + \frac{2i\bar{g}^3\bar{g}'^3v^2}{(\bar{g}^2 + \bar{g}'^2)^2} (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) C^{\varphi WB} \\
& - \frac{6i\bar{g}^3}{\bar{g}^2 + \bar{g}'^2} C^W (\eta_{\mu_1\mu_2}p_1^{\mu_4}p_4^{\mu_3} + \eta_{\mu_1\mu_2}p_2^{\mu_4}p_4^{\mu_3} + \eta_{\mu_1\mu_3}p_1^{\mu_4}p_3^{\mu_2} \\
& - \eta_{\mu_1\mu_3}p_2^{\mu_4}p_3^{\mu_2} - \eta_{\mu_1\mu_3}p_1^{\mu_2}p_3^{\mu_4} - \eta_{\mu_1\mu_3}p_1^{\mu_4}p_4^{\mu_2} - \eta_{\mu_1\mu_4}p_1^{\mu_2}p_4^{\mu_3} \\
& - \eta_{\mu_2\mu_3}p_1^{\mu_4}p_3^{\mu_1} + \eta_{\mu_2\mu_3}p_2^{\mu_4}p_3^{\mu_1} - \eta_{\mu_2\mu_3}p_2^{\mu_1}p_3^{\mu_4} - \eta_{\mu_2\mu_3}p_2^{\mu_4}p_4^{\mu_1} \\
& - \eta_{\mu_2\mu_4}p_2^{\mu_1}p_4^{\mu_3} + p_1^{\mu_3}(\eta_{\mu_1\mu_2}p_3^{\mu_4} - \eta_{\mu_1\mu_4}p_3^{\mu_2} + \eta_{\mu_1\mu_4}p_4^{\mu_2} - \eta_{\mu_2\mu_4}p_4^{\mu_1}) \\
& + p_2^{\mu_3}(\eta_{\mu_1\mu_2}p_3^{\mu_4} - \eta_{\mu_1\mu_4}p_4^{\mu_2} + \eta_{\mu_2\mu_4}(p_4^{\mu_1} - p_3^{\mu_1})) + \eta_{\mu_3\mu_4}p_1^{\mu_2}p_3^{\mu_1} \\
& + \eta_{\mu_3\mu_4}p_2^{\mu_1}p_3^{\mu_2} + \eta_{\mu_3\mu_4}p_1^{\mu_2}p_4^{\mu_1} + \eta_{\mu_3\mu_4}p_2^{\mu_2}p_4^{\mu_1} - p_1 \cdot p_3\eta_{\mu_3\mu_4}\eta_{\mu_1\mu_2} \\
& - p_1 \cdot p_4\eta_{\mu_3\mu_4}\eta_{\mu_1\mu_2} - p_2 \cdot p_3\eta_{\mu_3\mu_4}\eta_{\mu_1\mu_2} - p_2 \cdot p_4\eta_{\mu_3\mu_4}\eta_{\mu_1\mu_2} + p_1 \cdot p_3\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} \\
& + p_1 \cdot p_4\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} + p_2 \cdot p_3\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} + p_2 \cdot p_4\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}) \\
& + \frac{2i\bar{g}^3}{\bar{g}^2 + \bar{g}'^2} C^{\widetilde{W}} \left( -\epsilon_{\mu_2\mu_3\mu_1\alpha_1}p_1^{\mu_4}p_3^{\alpha_1} - \epsilon_{\mu_2\mu_3\mu_4\alpha_1}p_2^{\mu_1}p_3^{\alpha_1} + \epsilon_{\mu_2\mu_3\mu_1\alpha_1}p_2^{\mu_4}p_3^{\alpha_1} \right. \\
& - \epsilon_{\mu_2\mu_3\mu_4\alpha_1}p_1^{\alpha_1}p_3^{\mu_1} - \epsilon_{\mu_2\mu_3\mu_4\alpha_1}p_2^{\alpha_1}p_3^{\mu_1} - \epsilon_{\mu_2\mu_3\mu_1\alpha_1}p_1^{\alpha_1}p_3^{\mu_4} + \epsilon_{\mu_2\mu_3\mu_1\alpha_1}p_2^{\alpha_1}p_3^{\mu_4} \\
& - \epsilon_{\mu_2\mu_3\mu_1\alpha_1}p_1^{\mu_4}p_4^{\alpha_1} + \epsilon_{\mu_2\mu_3\mu_4\alpha_1}p_2^{\mu_1}p_4^{\alpha_1} + \epsilon_{\mu_2\mu_3\mu_1\alpha_1}p_2^{\mu_4}p_4^{\alpha_1} + \epsilon_{\mu_2\mu_3\mu_4\alpha_1}p_1^{\alpha_1}p_4^{\mu_1} \\
& + \epsilon_{\mu_2\mu_3\mu_4\alpha_1}p_2^{\alpha_1}p_4^{\mu_1} + \epsilon_{\mu_3\mu_1\mu_4\alpha_1}(p_1^{\mu_2}(p_3^{\alpha_1} - p_4^{\alpha_1}) + (p_1^{\alpha_1} + p_2^{\alpha_1})(p_3^{\mu_2} - p_4^{\mu_2})) \\
& + \epsilon_{\mu_2\mu_1\mu_4\alpha_1}(p_1^{\mu_3}(p_3^{\alpha_1} + p_4^{\alpha_1}) - p_2^{\mu_3}(p_3^{\alpha_1} + p_4^{\alpha_1}) + (p_1^{\alpha_1} - p_2^{\alpha_1})p_4^{\mu_3}) \\
& + \epsilon_{\mu_3\mu_4\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_1\mu_2} + \epsilon_{\mu_3\mu_4\alpha_1\beta_1}p_2^{\alpha_1}p_3^{\beta_1}\eta_{\mu_1\mu_2} - \epsilon_{\mu_3\mu_4\alpha_1\beta_1}p_1^{\alpha_1}p_4^{\beta_1}\eta_{\mu_1\mu_2} \\
& - \epsilon_{\mu_3\mu_4\alpha_1\beta_1}p_2^{\alpha_1}p_4^{\beta_1}\eta_{\mu_1\mu_2} + \epsilon_{\mu_2\mu_4\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_1\mu_3} + \epsilon_{\mu_2\mu_4\alpha_1\beta_1}p_2^{\alpha_1}p_3^{\beta_1}\eta_{\mu_1\mu_3} \\
& + \epsilon_{\mu_2\mu_4\alpha_1\beta_1}p_1^{\beta_1}p_4^{\alpha_1}\eta_{\mu_1\mu_3} + \epsilon_{\mu_2\mu_3\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_1\mu_4} + \epsilon_{\mu_2\mu_3\alpha_1\beta_1}p_1^{\alpha_1}p_4^{\beta_1}\eta_{\mu_1\mu_4} \\
& + \epsilon_{\mu_2\mu_3\alpha_1\beta_1}p_2^{\alpha_1}p_4^{\beta_1}\eta_{\mu_1\mu_4} + \epsilon_{\mu_1\mu_4\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_2\mu_3} + \epsilon_{\mu_1\mu_4\alpha_1\beta_1}p_2^{\alpha_1}p_3^{\beta_1}\eta_{\mu_2\mu_3} \\
& + \epsilon_{\mu_1\mu_4\alpha_1\beta_1}p_2^{\alpha_1}p_4^{\beta_1}\eta_{\mu_2\mu_3} - \epsilon_{\mu_3\mu_1\alpha_1\beta_1}p_2^{\alpha_1}p_3^{\beta_1}\eta_{\mu_2\mu_4} - \epsilon_{\mu_3\mu_1\alpha_1\beta_1}p_1^{\alpha_1}p_4^{\beta_1}\eta_{\mu_2\mu_4} \\
& - \epsilon_{\mu_3\mu_1\alpha_1\beta_1}p_2^{\alpha_1}p_4^{\beta_1}\eta_{\mu_2\mu_4} + \epsilon_{\mu_2\mu_1\alpha_1\beta_1}p_1^{\alpha_1}p_3^{\beta_1}\eta_{\mu_3\mu_4} - \epsilon_{\mu_2\mu_1\alpha_1\beta_1}p_2^{\alpha_1}p_3^{\beta_1}\eta_{\mu_3\mu_4} \\
& + \epsilon_{\mu_2\mu_1\alpha_1\beta_1}p_1^{\alpha_1}p_4^{\beta_1}\eta_{\mu_3\mu_4} - \epsilon_{\mu_2\mu_1\alpha_1\beta_1}p_2^{\alpha_1}p_4^{\beta_1}\eta_{\mu_3\mu_4} - \epsilon_{\mu_2\mu_3\mu_1\mu_4}p_1 \cdot p_3 \\
& \left. + \epsilon_{\mu_2\mu_3\mu_1\mu_4}p_1 \cdot p_4 + \epsilon_{\mu_2\mu_3\mu_1\mu_4}p_2 \cdot p_3 - \epsilon_{\mu_2\mu_3\mu_1\mu_4}p_2 \cdot p_4 \right)
\end{aligned}$$

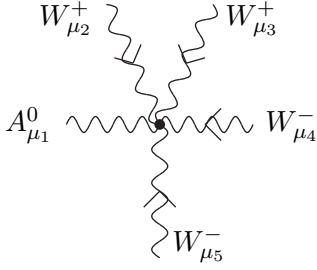


$$\begin{aligned}
& + \frac{6i\bar{g}^2\bar{g}'^3}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^W (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}(-p_3^{\mu_5}) - 2\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3}p_1^{\mu_4} + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3}p_2^{\mu_4} \\
& + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3}p_3^{\mu_4} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}p_3^{\mu_5} + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_1^{\mu_3} - \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_2^{\mu_3} \\
& + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_1^{\mu_4} - 2\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_2^{\mu_4} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_3^{\mu_4} - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_1^{\mu_3} \\
& + \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_2^{\mu_3} + 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}p_3^{\mu_5} + \eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4}p_1^{\mu_2} - \eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4}p_2^{\mu_2} \\
& + \eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4}p_2^{\mu_1} - \eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4}p_3^{\mu_1} + (2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4})p_1^{\mu_5} \\
& - (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - 2\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} + \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4})p_2^{\mu_5} + \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5}p_1^{\mu_4} \\
& + \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5}p_2^{\mu_4} - 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5}p_3^{\mu_4} - \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_1^{\mu_2} \\
& + \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_2^{\mu_2} - \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5}p_2^{\mu_1} + \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5}p_3^{\mu_1}) \\
& + \frac{2i\bar{g}^2\bar{g}'^3}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\widetilde{W}} (2\eta_{\mu_1\mu_2}p_1^{\alpha_1}\epsilon_{\mu_3\mu_4\mu_5\alpha_1} + 2\eta_{\mu_1\mu_2}p_2^{\alpha_1}\epsilon_{\mu_3\mu_4\mu_5\alpha_1} + 2\eta_{\mu_1\mu_2}p_3^{\alpha_1}\epsilon_{\mu_3\mu_4\mu_5\alpha_1} + 2\eta_{\mu_1\mu_2}p_4^{\alpha_1}\epsilon_{\mu_3\mu_4\mu_5\alpha_1} + 2\eta_{\mu_1\mu_2}p_5^{\alpha_1}\epsilon_{\mu_3\mu_4\mu_5\alpha_1})
\end{aligned}$$

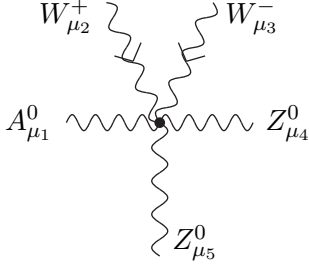




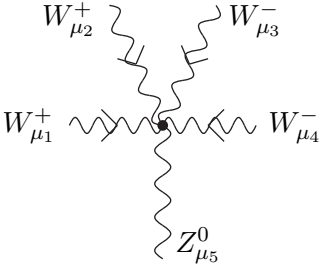
$$\begin{aligned}
& + \frac{6i\bar{g}^3\bar{g}'^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^W (\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3}(-p_1^{\mu_4}) + 2\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3}p_2^{\mu_4} \\
& - \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3}p_5^{\mu_4} - \eta_{\mu_4\mu_5}\eta_{\mu_2\mu_3}p_2^{\mu_1} + \eta_{\mu_4\mu_5}\eta_{\mu_2\mu_3}p_5^{\mu_1} + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_1^{\mu_3} \\
& - 2\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_2^{\mu_3} + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_5^{\mu_3} + (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4})p_1^{\mu_5} \\
& + (\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3})p_2^{\mu_5} + 2\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_1^{\mu_4} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_2^{\mu_4} \\
& - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_5^{\mu_4} - 2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_1^{\mu_3} + \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_2^{\mu_3} + \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_5^{\mu_3} \\
& - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5}p_1^{\mu_4} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5}p_2^{\mu_4} + 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5}p_5^{\mu_4} + \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_1^{\mu_2} \\
& - \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_5^{\mu_2} + \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5}p_2^{\mu_1} - \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5}p_5^{\mu_1} + \eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5}p_1^{\mu_3} \\
& + \eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5}p_2^{\mu_3} - 2\eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5}p_5^{\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}p_1^{\mu_2} + \eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}p_5^{\mu_2}) \\
& + \frac{2i\bar{g}^3\bar{g}'^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\widetilde{W}} (2\eta_{\mu_1\mu_2}p_1^{\alpha_1}\epsilon_{\mu_5\mu_3\mu_4\alpha_1} + 2\eta_{\mu_1\mu_2}p_2^{\alpha_1}\epsilon_{\mu_5\mu_3\mu_4\alpha_1} + 2\eta_{\mu_1\mu_2}p_5^{\alpha_1}\epsilon_{\mu_5\mu_3\mu_4\alpha_1} - \eta_{\mu_1\mu_2}p_1^{\alpha_1}\epsilon_{\mu_5\mu_3\mu_4\alpha_1} - \eta_{\mu_1\mu_2}p_2^{\alpha_1}\epsilon_{\mu_5\mu_3\mu_4\alpha_1} - \eta_{\mu_1\mu_2}p_5^{\alpha_1}\epsilon_{\mu_5\mu_3\mu_4\alpha_1})
\end{aligned}$$



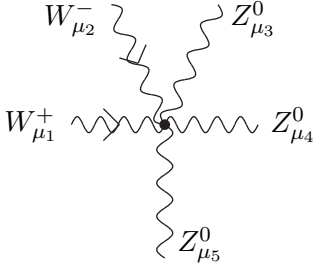
$$\begin{aligned}
& + \frac{6i\bar{g}^2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^W (-2p_4^{\mu_5} \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} \\
& + p_2^{\mu_4} \eta_{\mu_1\mu_5} \eta_{\mu_2\mu_3} + p_3^{\mu_4} \eta_{\mu_1\mu_5} \eta_{\mu_2\mu_3} \\
& - 2p_5^{\mu_4} \eta_{\mu_1\mu_5} \eta_{\mu_2\mu_3} - 2p_2^{\mu_1} \eta_{\mu_4\mu_5} \eta_{\mu_2\mu_3} \\
& - 2p_3^{\mu_1} \eta_{\mu_4\mu_5} \eta_{\mu_2\mu_3} + 2p_4^{\mu_1} \eta_{\mu_4\mu_5} \eta_{\mu_2\mu_3} \\
& + 2p_5^{\mu_1} \eta_{\mu_4\mu_5} \eta_{\mu_2\mu_3} + p_4^{\mu_5} \eta_{\mu_1\mu_3} \eta_{\mu_2\mu_4} \\
& - p_2^{\mu_3} \eta_{\mu_1\mu_5} \eta_{\mu_2\mu_4} + p_5^{\mu_3} \eta_{\mu_1\mu_5} \eta_{\mu_2\mu_4} \\
& + p_3^{\mu_5} (\eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3} \eta_{\mu_2\mu_4}) \\
& - p_3^{\mu_4} \eta_{\mu_1\mu_3} \eta_{\mu_2\mu_5} \\
& + p_5^{\mu_4} \eta_{\mu_1\mu_3} \eta_{\mu_2\mu_5} - p_2^{\mu_3} \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_5} \\
& + p_4^{\mu_3} \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_5} + p_4^{\mu_5} \eta_{\mu_1\mu_2} \eta_{\mu_3\mu_4} \\
& - p_3^{\mu_2} \eta_{\mu_1\mu_5} \eta_{\mu_3\mu_4} + p_5^{\mu_2} \eta_{\mu_1\mu_5} \eta_{\mu_3\mu_4} \\
& + p_2^{\mu_1} \eta_{\mu_2\mu_5} \eta_{\mu_3\mu_4} + p_3^{\mu_1} \eta_{\mu_2\mu_5} \eta_{\mu_3\mu_4} \\
& - p_4^{\mu_1} \eta_{\mu_2\mu_5} \eta_{\mu_3\mu_4} - p_5^{\mu_1} \eta_{\mu_2\mu_5} \eta_{\mu_3\mu_4} \\
& + p_2^{\mu_5} (\eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_2} \eta_{\mu_3\mu_4}) \\
& - p_2^{\mu_4} \eta_{\mu_1\mu_2} \eta_{\mu_3\mu_5} + p_5^{\mu_4} \eta_{\mu_1\mu_2} \eta_{\mu_3\mu_5} \\
& - p_3^{\mu_2} \eta_{\mu_1\mu_4} \eta_{\mu_3\mu_5} + p_4^{\mu_2} \eta_{\mu_1\mu_4} \eta_{\mu_3\mu_5} \\
& + p_2^{\mu_1} \eta_{\mu_2\mu_4} \eta_{\mu_3\mu_5} + p_3^{\mu_1} \eta_{\mu_2\mu_4} \eta_{\mu_3\mu_5} \\
& - p_4^{\mu_1} \eta_{\mu_2\mu_4} \eta_{\mu_3\mu_5} - p_5^{\mu_1} \eta_{\mu_2\mu_4} \eta_{\mu_3\mu_5} \\
& + 2p_2^{\mu_3} \eta_{\mu_1\mu_2} \eta_{\mu_4\mu_5} - p_4^{\mu_3} \eta_{\mu_1\mu_2} \eta_{\mu_4\mu_5} \\
& - p_5^{\mu_3} \eta_{\mu_1\mu_2} \eta_{\mu_4\mu_5} + 2p_3^{\mu_2} \eta_{\mu_1\mu_3} \eta_{\mu_4\mu_5} \\
& - p_4^{\mu_2} \eta_{\mu_1\mu_3} \eta_{\mu_4\mu_5} - p_5^{\mu_2} \eta_{\mu_1\mu_3} \eta_{\mu_4\mu_5}) \\
& - \frac{2i\bar{g}^2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\widetilde{W}} (2\epsilon_{\mu_1\mu_2\mu_3\mu_5} (p_2^{\mu_4} - p_3^{\mu_4}) \\
& + 2\epsilon_{\mu_1\mu_4\mu_2\mu_3} (p_2^{\mu_5} - p_3^{\mu_5}) \\
& + 2\epsilon_{\mu_1\mu_4\mu_3\mu_5} p_4^{\mu_2} + 2\epsilon_{\mu_1\mu_4\mu_2\mu_5} p_4^{\mu_3} \\
& - 2\epsilon_{\mu_1\mu_4\mu_3\mu_5} p_5^{\mu_2} - 2\epsilon_{\mu_1\mu_4\mu_2\mu_5} p_5^{\mu_3} \\
& - \epsilon_{\mu_4\mu_3\mu_5\alpha_1} p_4^{\alpha_1} \eta_{\mu_1\mu_2} + \epsilon_{\mu_4\mu_3\mu_5\alpha_1} p_5^{\alpha_1} \eta_{\mu_1\mu_2} \\
& - \epsilon_{\mu_4\mu_2\mu_5\alpha_1} p_4^{\alpha_1} \eta_{\mu_1\mu_3} + \epsilon_{\mu_4\mu_2\mu_5\alpha_1} p_5^{\alpha_1} \eta_{\mu_1\mu_3} \\
& - \epsilon_{\mu_2\mu_3\mu_5\alpha_1} p_2^{\alpha_1} \eta_{\mu_1\mu_4} + \epsilon_{\mu_2\mu_3\mu_5\alpha_1} p_3^{\alpha_1} \eta_{\mu_1\mu_4} \\
& - \epsilon_{\mu_4\mu_2\mu_3\alpha_1} p_2^{\alpha_1} \eta_{\mu_1\mu_5} + \epsilon_{\mu_4\mu_2\mu_3\alpha_1} p_3^{\alpha_1} \eta_{\mu_1\mu_5} \\
& - 2\epsilon_{\mu_1\mu_4\mu_5\alpha_1} p_4^{\alpha_1} \eta_{\mu_2\mu_3} + 2\epsilon_{\mu_1\mu_4\mu_5\alpha_1} p_5^{\alpha_1} \eta_{\mu_2\mu_3} \\
& - 2\epsilon_{\mu_1\mu_3\mu_5\alpha_1} p_2^{\alpha_1} \eta_{\mu_2\mu_4} - \epsilon_{\mu_1\mu_3\mu_5\alpha_1} p_3^{\alpha_1} \eta_{\mu_2\mu_4} \\
& - 2\epsilon_{\mu_1\mu_3\mu_5\alpha_1} p_4^{\alpha_1} \eta_{\mu_2\mu_4} - \epsilon_{\mu_1\mu_3\mu_5\alpha_1} p_5^{\alpha_1} \eta_{\mu_2\mu_4} \\
& + 2\epsilon_{\mu_1\mu_4\mu_3\alpha_1} p_2^{\alpha_1} \eta_{\mu_2\mu_5} + \epsilon_{\mu_1\mu_4\mu_3\alpha_1} p_3^{\alpha_1} \eta_{\mu_2\mu_5} \\
& + \epsilon_{\mu_1\mu_4\mu_3\alpha_1} p_4^{\alpha_1} \eta_{\mu_2\mu_5} + 2\epsilon_{\mu_1\mu_4\mu_3\alpha_1} p_5^{\alpha_1} \eta_{\mu_2\mu_5} \\
& - \epsilon_{\mu_1\mu_2\mu_5\alpha_1} p_2^{\alpha_1} \eta_{\mu_3\mu_4} - 2\epsilon_{\mu_1\mu_2\mu_5\alpha_1} p_3^{\alpha_1} \eta_{\mu_3\mu_4} \\
& - 2\epsilon_{\mu_1\mu_2\mu_5\alpha_1} p_4^{\alpha_1} \eta_{\mu_3\mu_4} - \epsilon_{\mu_1\mu_2\mu_5\alpha_1} p_5^{\alpha_1} \eta_{\mu_3\mu_4} \\
& + \epsilon_{\mu_1\mu_4\mu_2\alpha_1} p_2^{\alpha_1} \eta_{\mu_3\mu_5} + 2\epsilon_{\mu_1\mu_4\mu_2\alpha_1} p_3^{\alpha_1} \eta_{\mu_3\mu_5} \\
& + \epsilon_{\mu_1\mu_4\mu_2\alpha_1} p_4^{\alpha_1} \eta_{\mu_3\mu_5} + 2\epsilon_{\mu_1\mu_4\mu_2\alpha_1} p_5^{\alpha_1} \eta_{\mu_3\mu_5} \\
& + 2\epsilon_{\mu_1\mu_2\mu_3\alpha_1} p_2^{\alpha_1} \eta_{\mu_4\mu_5} - 2\epsilon_{\mu_1\mu_2\mu_3\alpha_1} p_3^{\alpha_1} \eta_{\mu_4\mu_5})
\end{aligned}$$



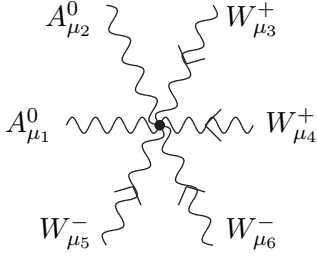
$$\begin{aligned}
& + \frac{6i\bar{g}^4\bar{g}'}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^W (\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}(-p_1^{\mu_3}) + 2\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_4^{\mu_3} - \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_5^{\mu_3} \\
& - \eta_{\mu_3\mu_5}\eta_{\mu_2\mu_4}p_4^{\mu_1} + \eta_{\mu_3\mu_5}\eta_{\mu_2\mu_4}p_5^{\mu_1} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_1^{\mu_4} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_5^{\mu_4} \\
& - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_1^{\mu_3} - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_4^{\mu_3} + 2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_5^{\mu_3} + \eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4}p_1^{\mu_2} \\
& - 2\eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4}p_4^{\mu_2} + \eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4}p_5^{\mu_2} + \eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4}p_4^{\mu_1} - \eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4}p_5^{\mu_1} \\
& + (\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4})p_1^{\mu_5} + (\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4})p_4^{\mu_5} \\
& - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5}p_1^{\mu_4} + \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5}p_5^{\mu_4} + \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_1^{\mu_2} + \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_4^{\mu_2} \\
& - 2\eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_5^{\mu_2} + 2\eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5}p_1^{\mu_3} - \eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5}p_4^{\mu_3} \\
& - \eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5}p_5^{\mu_3} - 2\eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}p_1^{\mu_2} + \eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}p_4^{\mu_2} + \eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}p_5^{\mu_2}) \\
& + \frac{2i\bar{g}^4\bar{g}'}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\tilde{W}} (\eta_{\mu_1\mu_2}p_4^{\alpha_1}\epsilon_{\mu_4\mu_3\mu_5\alpha_1} - \eta_{\mu_1\mu_2}p_5^{\alpha_1}\epsilon_{\mu_4\mu_3\mu_5\alpha_1} - \eta_{\mu_1\mu_3}p_4^{\alpha_1}\epsilon_{\mu_4\mu_2\mu_5\alpha_1} + \eta_{\mu_1\mu_3}p_5^{\alpha_1}\epsilon_{\mu_4\mu_2\mu_5\alpha_1} \\
& + \eta_{\mu_1\mu_4}p_4^{\alpha_1}\epsilon_{\mu_3\mu_2\mu_5\alpha_1} - \eta_{\mu_1\mu_4}p_5^{\alpha_1}\epsilon_{\mu_3\mu_2\mu_5\alpha_1} - \eta_{\mu_2\mu_4}p_4^{\alpha_1}\epsilon_{\mu_3\mu_1\mu_5\alpha_1} + \eta_{\mu_2\mu_4}p_5^{\alpha_1}\epsilon_{\mu_3\mu_1\mu_5\alpha_1} \\
& + \eta_{\mu_2\mu_5}p_4^{\alpha_1}\epsilon_{\mu_3\mu_1\mu_4\alpha_1} - \eta_{\mu_2\mu_5}p_5^{\alpha_1}\epsilon_{\mu_3\mu_1\mu_4\alpha_1} - \eta_{\mu_3\mu_4}p_4^{\alpha_1}\epsilon_{\mu_2\mu_1\mu_5\alpha_1} + \eta_{\mu_3\mu_4}p_5^{\alpha_1}\epsilon_{\mu_2\mu_1\mu_5\alpha_1} \\
& + \eta_{\mu_3\mu_5}p_4^{\alpha_1}\epsilon_{\mu_2\mu_1\mu_4\alpha_1} - \eta_{\mu_3\mu_5}p_5^{\alpha_1}\epsilon_{\mu_2\mu_1\mu_4\alpha_1} - \eta_{\mu_4\mu_5}p_4^{\alpha_1}\epsilon_{\mu_2\mu_1\mu_3\alpha_1} + \eta_{\mu_4\mu_5}p_5^{\alpha_1}\epsilon_{\mu_2\mu_1\mu_3\alpha_1})
\end{aligned}$$



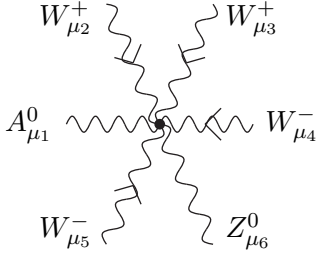
$$\begin{aligned}
& + \frac{6i\bar{g}^3}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^W (-p_3^{\mu_5}\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - p_4^{\mu_5}\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - p_1^{\mu_4}\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3} \\
& + p_3^{\mu_4}\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3} - p_2^{\mu_1}\eta_{\mu_4\mu_5}\eta_{\mu_2\mu_3} + p_4^{\mu_1}\eta_{\mu_4\mu_5}\eta_{\mu_2\mu_3} - p_3^{\mu_5}\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} \\
& - p_4^{\mu_5}\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - p_1^{\mu_3}\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4} + p_4^{\mu_3}\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4} - p_2^{\mu_4}\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5} \\
& + p_3^{\mu_4}\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5} - p_2^{\mu_3}\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5} + p_4^{\mu_3}\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5} + 2p_3^{\mu_5}\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4} \\
& + 2p_4^{\mu_5}\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4} + 2p_1^{\mu_2}\eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4} - p_3^{\mu_2}\eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4} \\
& - p_4^{\mu_2}\eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4} + 2p_2^{\mu_1}\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4} - p_3^{\mu_1}\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4} \\
& - p_4^{\mu_1}\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4} + p_1^{\mu_5}(\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) \\
& + p_2^{\mu_5}(\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) + p_1^{\mu_4}\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5} \\
& + p_2^{\mu_4}\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5} - 2p_3^{\mu_4}\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_5} - p_1^{\mu_2}\eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5} + p_3^{\mu_2}\eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5} \\
& - p_2^{\mu_1}\eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5} + p_3^{\mu_1}\eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5} + p_1^{\mu_3}\eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5} + p_2^{\mu_3}\eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5} \\
& - 2p_4^{\mu_3}\eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5} - p_1^{\mu_2}\eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5} + p_4^{\mu_2}\eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}) \\
& + \frac{2i\bar{g}^3}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\tilde{W}} (2\epsilon_{\mu_1\mu_2\mu_4\mu_5}(p_1^{\mu_3} - p_2^{\mu_3}) + 2\epsilon_{\mu_3\mu_1\mu_2\mu_5}(p_1^{\mu_4} - p_2^{\mu_4}) + 2\epsilon_{\mu_3\mu_2\mu_4\mu_5}p_3^{\mu_1} \\
& + 2\epsilon_{\mu_3\mu_1\mu_4\mu_5}p_3^{\mu_2} - 2\epsilon_{\mu_3\mu_2\mu_4\mu_5}p_4^{\mu_1} - 2\epsilon_{\mu_3\mu_1\mu_4\mu_5}p_4^{\mu_2} + 2\epsilon_{\mu_3\mu_4\mu_5\alpha_1}p_3^{\alpha_1}\eta_{\mu_1\mu_2} \\
& - 2\epsilon_{\mu_3\mu_4\mu_5\alpha_1}p_4^{\alpha_1}\eta_{\mu_1\mu_2} + 2\epsilon_{\mu_2\mu_4\mu_5\alpha_1}p_1^{\alpha_1}\eta_{\mu_1\mu_3} + \epsilon_{\mu_2\mu_4\mu_5\alpha_1}p_2^{\alpha_1}\eta_{\mu_1\mu_3} \\
& + 2\epsilon_{\mu_2\mu_4\mu_5\alpha_1}p_3^{\alpha_1}\eta_{\mu_1\mu_3} + \epsilon_{\mu_2\mu_4\mu_5\alpha_1}p_4^{\alpha_1}\eta_{\mu_1\mu_3} - 2\epsilon_{\mu_3\mu_2\mu_5\alpha_1}p_1^{\alpha_1}\eta_{\mu_1\mu_4} \\
& - \epsilon_{\mu_3\mu_2\mu_5\alpha_1}p_2^{\alpha_1}\eta_{\mu_1\mu_4} - \epsilon_{\mu_3\mu_2\mu_5\alpha_1}p_3^{\alpha_1}\eta_{\mu_1\mu_4} - 2\epsilon_{\mu_3\mu_2\mu_5\alpha_1}p_4^{\alpha_1}\eta_{\mu_1\mu_4} \\
& + \epsilon_{\mu_3\mu_2\mu_4\alpha_1}p_3^{\alpha_1}\eta_{\mu_1\mu_5} - \epsilon_{\mu_3\mu_2\mu_4\alpha_1}p_4^{\alpha_1}\eta_{\mu_1\mu_5} + \epsilon_{\mu_1\mu_4\mu_5\alpha_1}p_1^{\alpha_1}\eta_{\mu_2\mu_3} \\
& + 2\epsilon_{\mu_1\mu_4\mu_5\alpha_1}p_2^{\alpha_1}\eta_{\mu_2\mu_3} + 2\epsilon_{\mu_1\mu_4\mu_5\alpha_1}p_3^{\alpha_1}\eta_{\mu_2\mu_3} + \epsilon_{\mu_1\mu_4\mu_5\alpha_1}p_4^{\alpha_1}\eta_{\mu_2\mu_3} \\
& - \epsilon_{\mu_3\mu_1\mu_5\alpha_1}p_1^{\alpha_1}\eta_{\mu_2\mu_4} - 2\epsilon_{\mu_3\mu_1\mu_5\alpha_1}p_2^{\alpha_1}\eta_{\mu_2\mu_4} - \epsilon_{\mu_3\mu_1\mu_5\alpha_1}p_3^{\alpha_1}\eta_{\mu_2\mu_4} \\
& - 2\epsilon_{\mu_3\mu_1\mu_5\alpha_1}p_4^{\alpha_1}\eta_{\mu_2\mu_4} + \epsilon_{\mu_3\mu_1\mu_4\alpha_1}p_3^{\alpha_1}\eta_{\mu_2\mu_5} - \epsilon_{\mu_3\mu_1\mu_4\alpha_1}p_4^{\alpha_1}\eta_{\mu_2\mu_5} \\
& - 2\epsilon_{\mu_1\mu_2\mu_5\alpha_1}p_1^{\alpha_1}\eta_{\mu_3\mu_4} + 2\epsilon_{\mu_1\mu_2\mu_5\alpha_1}p_2^{\alpha_1}\eta_{\mu_3\mu_4} + \epsilon_{\mu_1\mu_2\mu_4\alpha_1}p_1^{\alpha_1}\eta_{\mu_3\mu_5} \\
& - \epsilon_{\mu_1\mu_2\mu_4\alpha_1}p_2^{\alpha_1}\eta_{\mu_3\mu_5} + \epsilon_{\mu_3\mu_1\mu_2\alpha_1}p_1^{\alpha_1}\eta_{\mu_4\mu_5} - \epsilon_{\mu_3\mu_1\mu_2\alpha_1}p_2^{\alpha_1}\eta_{\mu_4\mu_5})
\end{aligned}$$



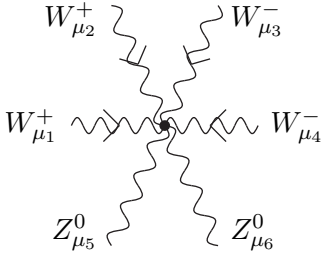
$$\begin{aligned}
& + \frac{6i\bar{g}^5}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^W (\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3}p_3^{\mu_4} - \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_3}p_5^{\mu_4} - 2\eta_{\mu_4\mu_5}\eta_{\mu_2\mu_3}p_3^{\mu_1} \\
& + \eta_{\mu_4\mu_5}\eta_{\mu_2\mu_3}p_4^{\mu_1} + \eta_{\mu_4\mu_5}\eta_{\mu_2\mu_3}p_5^{\mu_1} + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_4^{\mu_3} - \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4}p_5^{\mu_3} \\
& + (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4})p_3^{\mu_5} + (\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3})p_4^{\mu_5} \\
& - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_3^{\mu_4} + \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}p_5^{\mu_4} - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_4^{\mu_3} + \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}p_5^{\mu_3} \\
& - \eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4}p_3^{\mu_2} - \eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4}p_4^{\mu_2} + 2\eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4}p_5^{\mu_2} \\
& + \eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4}p_3^{\mu_1} + \eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4}p_4^{\mu_1} - 2\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4}p_5^{\mu_1} - \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_3^{\mu_2} \\
& + 2\eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_4^{\mu_2} - \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5}p_5^{\mu_2} + \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5}p_3^{\mu_1} - 2\eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5}p_4^{\mu_1} \\
& + \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5}p_5^{\mu_1} + 2\eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}p_3^{\mu_2} - \eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}p_4^{\mu_2} - \eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}p_5^{\mu_2}) \\
& + \frac{2i\bar{g}^5}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\widetilde{W}} (-\eta_{\mu_1\mu_3}p_4^{\alpha_1}\epsilon_{\mu_2\mu_4\mu_5\alpha_1} + \eta_{\mu_1\mu_3}p_5^{\alpha_1}\epsilon_{\mu_2\mu_4\mu_5\alpha_1} + \eta_{\mu_1\mu_4}p_3^{\alpha_1}\epsilon_{\mu_3\mu_2\mu_5\alpha_1} - \eta_{\mu_1\mu_4}p_5^{\alpha_1}\epsilon_{\mu_3\mu_2\mu_5\alpha_1} - \eta_{\mu_1\mu_5}p_3^{\alpha_1}\epsilon_{\mu_3\mu_2\mu_4\alpha_1} + \eta_{\mu_1\mu_5}p_5^{\alpha_1}\epsilon_{\mu_3\mu_2\mu_4\alpha_1})
\end{aligned}$$



$$\begin{aligned}
& - \frac{12i\bar{g}^3\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} (-\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_6}\eta_{\mu_3\mu_5} + 2\eta_{\mu_1\mu_2}\eta_{\mu_4\mu_6}\eta_{\mu_3\mu_5} \\
& - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_6} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_6}\eta_{\mu_4\mu_5} + 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_6}\eta_{\mu_4\mu_5} \\
& + \eta_{\mu_1\mu_6}(2\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4} - \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5} - \eta_{\mu_2\mu_3}\eta_{\mu_4\mu_5}) \\
& - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}\eta_{\mu_4\mu_6} + \eta_{\mu_1\mu_5}(2\eta_{\mu_2\mu_6}\eta_{\mu_3\mu_4} - \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_6} - \eta_{\mu_2\mu_3}\eta_{\mu_4\mu_6}) \\
& + 2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}\eta_{\mu_5\mu_6} + 2\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}\eta_{\mu_5\mu_6} - 4\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}\eta_{\mu_5\mu_6}) C^W
\end{aligned}$$

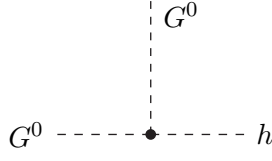


$$\begin{aligned}
& - \frac{12i\bar{g}^4\bar{g}'}{\bar{g}^2 + \bar{g}'^2} (-\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_6}\eta_{\mu_3\mu_5} - \eta_{\mu_1\mu_2}\eta_{\mu_4\mu_6}\eta_{\mu_3\mu_5} \\
& - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_6} + 2\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_6}\eta_{\mu_4\mu_5} + 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_6}\eta_{\mu_4\mu_5} \\
& + 2\eta_{\mu_1\mu_6}(\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4} + \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5} - 2\eta_{\mu_2\mu_3}\eta_{\mu_4\mu_5}) \\
& - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}\eta_{\mu_4\mu_6} - \eta_{\mu_1\mu_5}(\eta_{\mu_2\mu_6}\eta_{\mu_3\mu_4} + \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_6} - 2\eta_{\mu_2\mu_3}\eta_{\mu_4\mu_6}) \\
& + 2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}\eta_{\mu_5\mu_6} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}\eta_{\mu_5\mu_6} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}\eta_{\mu_5\mu_6}) C^W
\end{aligned}$$

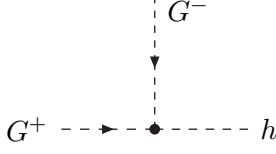


$$\begin{aligned}
& - \frac{12i\bar{g}^5}{\bar{g}^2 + \bar{g}'^2} (-\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_6}\eta_{\mu_3\mu_5} + 2\eta_{\mu_1\mu_2}\eta_{\mu_4\mu_6}\eta_{\mu_3\mu_5} \\
& - \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_6} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_6}\eta_{\mu_4\mu_5} + 2\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_6}\eta_{\mu_4\mu_5} \\
& + \eta_{\mu_1\mu_6}(2\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4} - \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5} - \eta_{\mu_2\mu_3}\eta_{\mu_4\mu_5}) \\
& - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_5}\eta_{\mu_4\mu_6} + \eta_{\mu_1\mu_5}(2\eta_{\mu_2\mu_6}\eta_{\mu_3\mu_4} - \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_6} - \eta_{\mu_2\mu_3}\eta_{\mu_4\mu_6}) \\
& + 2\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3}\eta_{\mu_5\mu_6} + 2\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}\eta_{\mu_5\mu_6} - 4\eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}\eta_{\mu_5\mu_6}) C^W
\end{aligned}$$

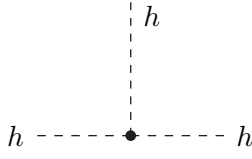
## A.7 Higgs–gauge vertices



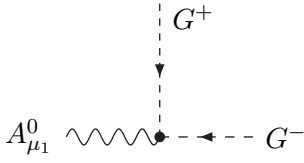
$$-i\lambda v + 3iv^3 C^\varphi - iv C^{\varphi\Box} (p_1 \cdot p_1 + 2p_1 \cdot p_2 + p_2 \cdot p_2 + p_3 \cdot p_3 + \lambda v^2) + \frac{iv}{4} C^{\varphi D} (3\lambda v^2 - 4p_1 \cdot p_2)$$



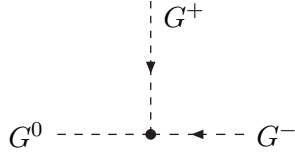
$$-i\lambda v + 3iv^3 C^\varphi - iv C^{\varphi\Box} (p_1 \cdot p_1 + 2p_1 \cdot p_2 + p_2 \cdot p_2 + p_3 \cdot p_3 + \lambda v^2) + \frac{iv}{4} C^{\varphi D} (\lambda v^2 - 2(p_1 \cdot p_3 + p_2 \cdot p_3))$$



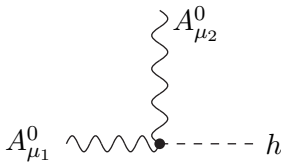
$$-3i\lambda v + 15iv^3 C^\varphi - iv C^{\varphi\Box} (3p_1 \cdot p_1 + 2p_1 \cdot p_2 + 2p_1 \cdot p_3 + 3p_2 \cdot p_2 + 2p_2 \cdot p_3 + 3p_3 \cdot p_3 + 9\lambda v^2) + \frac{iv}{4} C^{\varphi D} (9\lambda v^2 - 4(p_1 \cdot p_2 + p_1 \cdot p_3 + p_2 \cdot p_3))$$



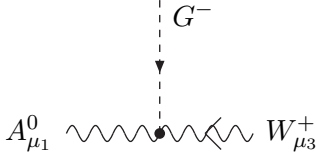
$$-\frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} (p_2^{\mu_1} - p_3^{\mu_1}) + \frac{i\bar{g}^2 \bar{g}'^2 v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi WB} (p_2^{\mu_1} - p_3^{\mu_1})$$



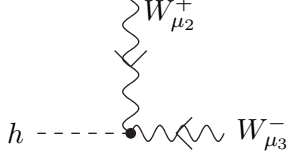
$$-\frac{v}{2} (p_1 \cdot p_2 - p_1 \cdot p_3) C^{\varphi D}$$



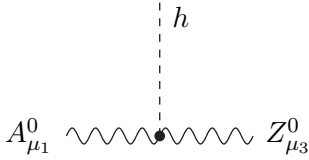
$$\begin{aligned} & + \frac{4i\bar{g}^2 v}{\bar{g}^2 + \bar{g}'^2} C^{\varphi B} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) + \frac{4i\bar{g}^2 v}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{B}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1} \\ & + \frac{4i\bar{g}'^2 v}{\bar{g}^2 + \bar{g}'^2} C^{\varphi W} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) \\ & - \frac{4i\bar{g}\bar{g}' v}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) \\ & + \frac{4i\bar{g}'^2 v}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1} - \frac{4i\bar{g}\bar{g}' v}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{WB}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1} \end{aligned}$$



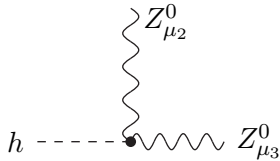
$$\begin{aligned}
& + \frac{i\bar{g}^2\bar{g}'v}{2\sqrt{\bar{g}^2+\bar{g}'^2}}\eta_{\mu_1\mu_3} \\
& - \frac{i\bar{g}v}{2(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}\left(\eta_{\mu_1\mu_3}\left(\bar{g}'^2(4p_1\cdot p_3+\bar{g}^2v^2)+4\bar{g}^2p_1\cdot p_3\right)\right. \\
& \left.-4\left(\bar{g}^2+\bar{g}'^2\right)p_1^{\mu_3}p_3^{\mu_1}\right)+\frac{2i\bar{g}v}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi\widetilde{W}B}p_1^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_1\mu_3\alpha_1\beta_1}
\end{aligned}$$



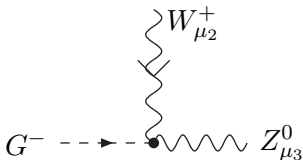
$$\begin{aligned}
& + \frac{1}{2}i\bar{g}^2v\eta_{\mu_2\mu_3} + \frac{1}{2}i\bar{g}^2v^3\eta_{\mu_2\mu_3}C^{\varphi\Box} - \frac{1}{8}i\bar{g}^2v^3\eta_{\mu_2\mu_3}C^{\varphi D} \\
& + 4ivC^{\varphi W}(p_2^{\mu_3}p_3^{\mu_2}-p_2\cdot p_3\eta_{\mu_2\mu_3})+4ivC^{\varphi\widetilde{W}}p_2^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_2\mu_3\alpha_1\beta_1} \\
& - \frac{4i\bar{g}\bar{g}'v}{\bar{g}^2+\bar{g}'^2}C^{\varphi B}(p_1^{\mu_3}p_3^{\mu_1}-p_1\cdot p_3\eta_{\mu_1\mu_3})-\frac{4i\bar{g}\bar{g}'v}{\bar{g}^2+\bar{g}'^2}C^{\varphi\widetilde{B}}p_1^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_1\mu_3\alpha_1\beta_1}
\end{aligned}$$



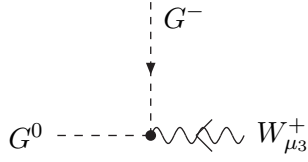
$$\begin{aligned}
& + \frac{4i\bar{g}\bar{g}'v}{\bar{g}^2+\bar{g}'^2}C^{\varphi W}(p_1^{\mu_3}p_3^{\mu_1}-p_1\cdot p_3\eta_{\mu_1\mu_3}) \\
& + \frac{2iv(\bar{g}'^2-\bar{g}^2)}{\bar{g}^2+\bar{g}'^2}C^{\varphi WB}(p_1^{\mu_3}p_3^{\mu_1}-p_1\cdot p_3\eta_{\mu_1\mu_3}) \\
& + \frac{4i\bar{g}\bar{g}'v}{\bar{g}^2+\bar{g}'^2}C^{\varphi\widetilde{W}}p_1^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_1\mu_3\alpha_1\beta_1} \\
& + \frac{2iv(\bar{g}'^2-\bar{g}^2)}{\bar{g}^2+\bar{g}'^2}C^{\varphi\widetilde{WB}}p_1^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_1\mu_3\alpha_1\beta_1}
\end{aligned}$$



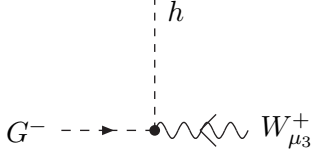
$$\begin{aligned}
& + \frac{iv}{2}(\bar{g}^2+\bar{g}'^2)\eta_{\mu_2\mu_3} + \frac{4i\bar{g}'^2v}{\bar{g}^2+\bar{g}'^2}C^{\varphi B}(p_2^{\mu_3}p_3^{\mu_2}-p_2\cdot p_3\eta_{\mu_2\mu_3}) \\
& + \frac{iv^3}{2}(\bar{g}^2+\bar{g}'^2)\eta_{\mu_2\mu_3}C^{\varphi\Box} + \frac{4i\bar{g}'^2v}{\bar{g}^2+\bar{g}'^2}C^{\varphi\widetilde{B}}p_2^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_2\mu_3\alpha_1\beta_1} \\
& + \frac{3iv^3}{8}(\bar{g}^2+\bar{g}'^2)\eta_{\mu_2\mu_3}C^{\varphi D} + \frac{4i\bar{g}^2v}{\bar{g}^2+\bar{g}'^2}C^{\varphi W}(p_2^{\mu_3}p_3^{\mu_2}-p_2\cdot p_3\eta_{\mu_2\mu_3}) \\
& + \frac{i\bar{g}\bar{g}'v}{\bar{g}^2+\bar{g}'^2}C^{\varphi WB}\left(\eta_{\mu_2\mu_3}\left(-4p_2\cdot p_3+\bar{g}^2v^2+\bar{g}'^2v^2\right)+4p_2^{\mu_3}p_3^{\mu_2}\right) \\
& + \frac{4i\bar{g}^2v}{\bar{g}^2+\bar{g}'^2}C^{\varphi\widetilde{W}}p_2^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_2\mu_3\alpha_1\beta_1} + \frac{4i\bar{g}\bar{g}'v}{\bar{g}^2+\bar{g}'^2}C^{\varphi\widetilde{WB}}p_2^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_2\mu_3\alpha_1\beta_1}
\end{aligned}$$



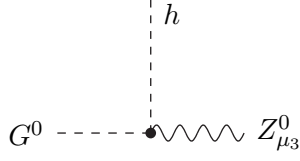
$$\begin{aligned}
& - \frac{i\bar{g}\bar{g}'^2v}{2\sqrt{\bar{g}^2+\bar{g}'^2}}\eta_{\mu_2\mu_3} - \frac{1}{4}i\bar{g}v^3\sqrt{\bar{g}^2+\bar{g}'^2}\eta_{\mu_2\mu_3}C^{\varphi D} \\
& - \frac{i\bar{g}'v}{2(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}\left(\eta_{\mu_2\mu_3}\left(-4\bar{g}^2p_2\cdot p_3-4\bar{g}'^2p_2\cdot p_3+\bar{g}^4v^2\right)\right. \\
& \left.+4\left(\bar{g}^2+\bar{g}'^2\right)p_2^{\mu_3}p_3^{\mu_2}\right)-\frac{2i\bar{g}'v}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi\widetilde{WB}}p_2^{\alpha_1}p_3^{\beta_1}\epsilon_{\mu_2\mu_3\alpha_1\beta_1}
\end{aligned}$$



$$+\frac{\bar{g}}{2}(p_1^{\mu_3}-p_2^{\mu_3})+\frac{\bar{g}v^2}{8}C^{\varphi D}(3p_1^{\mu_3}+p_2^{\mu_3})$$

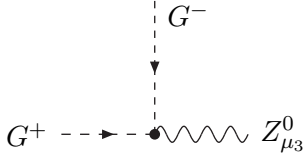


$$+\frac{i\bar{g}}{2}(p_1^{\mu_3}-p_2^{\mu_3})+\frac{1}{2}i\bar{g}v^2C^{\varphi\Box}(p_1^{\mu_3}-p_2^{\mu_3})-\frac{1}{8}i\bar{g}v^2C^{\varphi D}(p_1^{\mu_3}-p_2^{\mu_3})$$



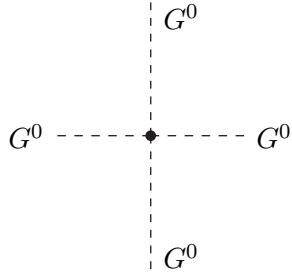
$$-\frac{1}{2}\sqrt{\bar{g}^2+\bar{g}'^2}(p_1^{\mu_3}-p_2^{\mu_3})-\frac{1}{2}v^2\sqrt{\bar{g}^2+\bar{g}'^2}C^{\varphi\Box}(p_1^{\mu_3}-p_2^{\mu_3})$$

$$-\frac{1}{2}v^2\sqrt{\bar{g}^2+\bar{g}'^2}C^{\varphi D}p_1^{\mu_3}-\frac{\bar{g}\bar{g}'v^2}{2\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi WB}(p_1^{\mu_3}-p_2^{\mu_3})$$



$$+\frac{i(\bar{g}'^2-\bar{g}^2)}{2\sqrt{\bar{g}^2+\bar{g}'^2}}(p_1^{\mu_3}-p_2^{\mu_3})+\frac{1}{4}iv^2\sqrt{\bar{g}^2+\bar{g}'^2}C^{\varphi D}(p_1^{\mu_3}-p_2^{\mu_3})$$

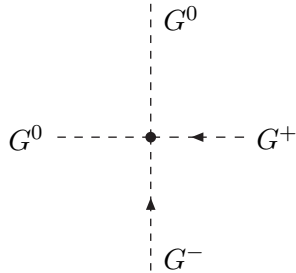
$$-\frac{i\bar{g}\bar{g}'v^2(\bar{g}'^2-\bar{g}^2)}{2(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}(p_1^{\mu_3}-p_2^{\mu_3})$$



$$-3i\lambda+9iv^2C^\varphi-i(3p_1\cdot p_1+2p_1\cdot p_2+2p_1\cdot p_3+2p_1\cdot p_4$$

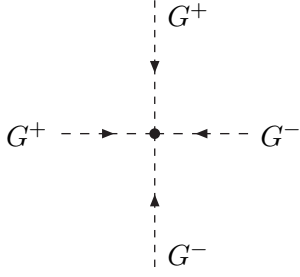
$$+3p_2\cdot p_2+2p_2\cdot p_3+2p_2\cdot p_4+3p_3\cdot p_3+2p_3\cdot p_4+3p_4\cdot p_4)C^{\varphi\Box}$$

$$+iC^{\varphi D}(-p_1\cdot p_2-p_1\cdot p_3-p_1\cdot p_4-p_2\cdot p_3-p_2\cdot p_4-p_3\cdot p_4+3\lambda v^2)$$

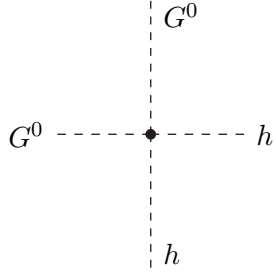


$$-i\lambda+3iv^2C^\varphi-i(p_1\cdot p_1+2p_1\cdot p_2+p_2\cdot p_2+p_3\cdot p_3+2p_3\cdot p_4+p_4\cdot p_4)C^{\varphi\Box}$$

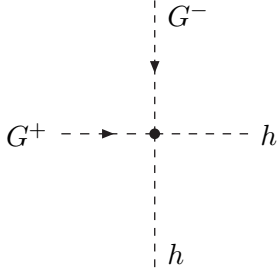
$$+\frac{i}{2}C^{\varphi D}(-p_1\cdot p_3-p_1\cdot p_4-p_2\cdot p_3-p_2\cdot p_4+\lambda v^2)$$



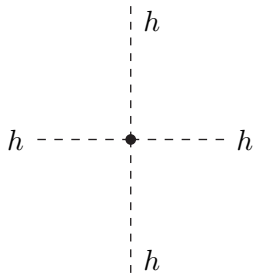
$$\begin{aligned}
& -2i\lambda + 6iv^2 C^\varphi \\
& - 2i(p_1 \cdot p_1 + p_1 \cdot p_3 + p_1 \cdot p_4 + p_2 \cdot p_2 + p_2 \cdot p_3 + p_2 \cdot p_4 + p_3 \cdot p_3 + p_4 \cdot p_4) C^{\varphi\Box} \\
& - i(p_1 \cdot p_3 + p_1 \cdot p_4 + p_2 \cdot p_3 + p_2 \cdot p_4) C^{\varphi D}
\end{aligned}$$



$$\begin{aligned}
& -i\lambda + 9iv^2 C^\varphi \\
& - iC^{\varphi\Box} (p_1 \cdot p_1 + 2p_1 \cdot p_2 + p_2 \cdot p_2 + p_3 \cdot p_3 + 2p_3 \cdot p_4 + p_4 \cdot p_4 + 2\lambda v^2) \\
& + iC^{\varphi D} (-p_1 \cdot p_2 - p_3 \cdot p_4 + \lambda v^2)
\end{aligned}$$

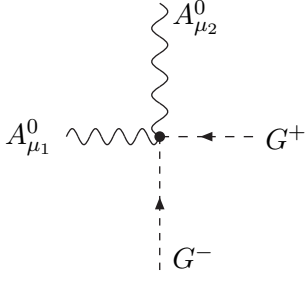


$$\begin{aligned}
& -i\lambda + 9iv^2 C^\varphi \\
& - iC^{\varphi\Box} (p_1 \cdot p_1 + 2p_1 \cdot p_2 + p_2 \cdot p_2 + p_3 \cdot p_3 + 2p_3 \cdot p_4 + p_4 \cdot p_4 + 2\lambda v^2) \\
& + \frac{i}{2} C^{\varphi D} (-p_1 \cdot p_3 - p_1 \cdot p_4 - p_2 \cdot p_3 - p_2 \cdot p_4 + \lambda v^2)
\end{aligned}$$

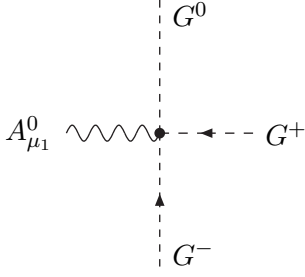


$$\begin{aligned}
& -3i\lambda + 45iv^2 C^\varphi - iC^{\varphi\Box} (3p_1 \cdot p_1 + 2p_1 \cdot p_2 + 2p_1 \cdot p_3 + 2p_1 \cdot p_4 \\
& + 3p_2 \cdot p_2 + 2p_2 \cdot p_3 + 2p_2 \cdot p_4 + 3p_3 \cdot p_3 + 2p_3 \cdot p_4 + 3p_4 \cdot p_4 + 12\lambda v^2) \\
& + iC^{\varphi D} (-p_1 \cdot p_2 - p_1 \cdot p_3 - p_1 \cdot p_4 - p_2 \cdot p_3 - p_2 \cdot p_4 - p_3 \cdot p_4 + 3\lambda v^2)
\end{aligned}$$

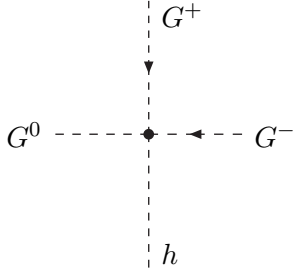




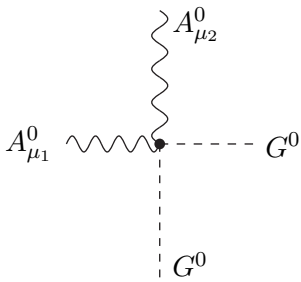
$$\begin{aligned}
& + \frac{2i\bar{g}^2\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} \eta_{\mu_1\mu_2} + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi B} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1\mu_2}) \\
& + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{B}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1\mu_2\alpha_1\beta_1} + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi W} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1\mu_2}) \\
& - \frac{4i\bar{g}\bar{g}'}{(\bar{g}^2 + \bar{g}'^2)^2} C^{\varphi WB} \left( \eta_{\mu_1\mu_2} \left( \bar{g}'^2 (p_1 \cdot p_2 + \bar{g}^2 v^2) + \bar{g}^2 p_1 \cdot p_2 \right) \right. \\
& \left. - (\bar{g}^2 + \bar{g}'^2) p_1^{\mu_2} p_2^{\mu_1} \right) + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1\mu_2\alpha_1\beta_1} \\
& + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W} B} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1\mu_2\alpha_1\beta_1}
\end{aligned}$$



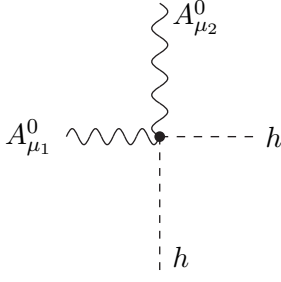
$$+ \frac{\bar{g}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi D} p_2^{\mu_1}$$



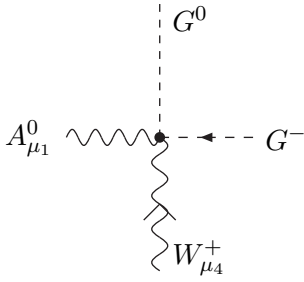
$$- \frac{1}{2} (p_1 \cdot p_2 - p_1 \cdot p_3 - p_2 \cdot p_4 + p_3 \cdot p_4) C^{\varphi D}$$



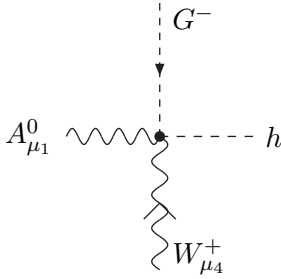
$$\begin{aligned}
& + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi B} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1\mu_2}) + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{B}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1\mu_2\alpha_1\beta_1} \\
& + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi W} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1\mu_2}) \\
& - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1\mu_2}) \\
& + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1\mu_2\alpha_1\beta_1} - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W} B} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1\mu_2\alpha_1\beta_1}
\end{aligned}$$



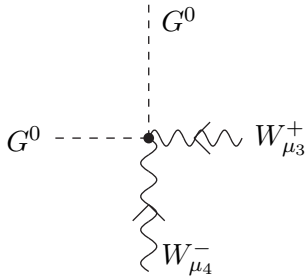
$$\begin{aligned}
& + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi B} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{B}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1} \\
& + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi W} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) \\
& - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) \\
& + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1} - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}B} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1}
\end{aligned}$$



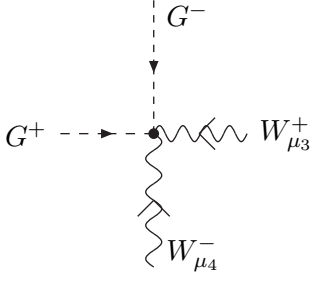
$$\begin{aligned}
& - \frac{\bar{g}^2 \bar{g}'}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_1 \mu_4} + \frac{\bar{g}^2 \bar{g}' v^2}{8\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_1 \mu_4} C^{\varphi D} \\
& - \frac{\bar{g}}{2(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi WB} \left( 4(\bar{g}^2 + \bar{g}'^2) p_1^{\mu_4} p_4^{\mu_1} \right. \\
& \left. - \eta_{\mu_1 \mu_4} (\bar{g}'^2 (4p_1 \cdot p_4 + \bar{g}^2 v^2) + 4\bar{g}^2 p_1 \cdot p_4) \right) \\
& - \frac{2\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \tilde{W}B} p_1^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_1 \mu_4 \alpha_1 \beta_1}
\end{aligned}$$



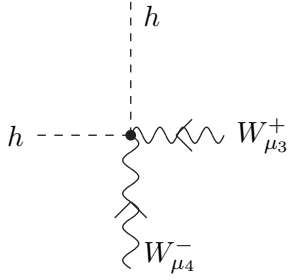
$$\begin{aligned}
& + \frac{i\bar{g}^2 \bar{g}'}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_1 \mu_4} + \frac{i\bar{g}^2 \bar{g}' v^2}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_1 \mu_4} C^{\varphi \square} - \frac{i\bar{g}^2 \bar{g}' v^2}{8\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_1 \mu_4} C^{\varphi D} \\
& + \frac{i\bar{g}}{2(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi WB} \left( 4(\bar{g}^2 + \bar{g}'^2) p_1^{\mu_4} p_4^{\mu_1} \right. \\
& \left. - \eta_{\mu_1 \mu_4} (\bar{g}'^2 (4p_1 \cdot p_4 + \bar{g}^2 v^2) + 4\bar{g}^2 p_1 \cdot p_4) \right) \\
& + \frac{2i\bar{g}}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \tilde{W}B} p_1^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_1 \mu_4 \alpha_1 \beta_1}
\end{aligned}$$



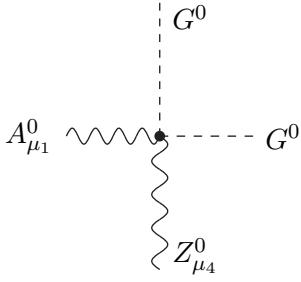
$$\begin{aligned}
& + \frac{i\bar{g}^2}{2} \eta_{\mu_3 \mu_4} - \frac{1}{4} i\bar{g}^2 v^2 \eta_{\mu_3 \mu_4} C^{\varphi D} \\
& + 4iC^{\varphi W} (p_3^{\mu_4} p_4^{\mu_3} - p_3 \cdot p_4 \eta_{\mu_3 \mu_4}) + 4iC^{\varphi \tilde{W}} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3 \mu_4 \alpha_1 \beta_1}
\end{aligned}$$



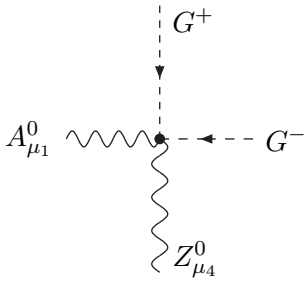
$$\begin{aligned}
& + \frac{i\bar{g}^2}{2}\eta_{\mu_3\mu_4} + \frac{1}{2}i\bar{g}^2v^2\eta_{\mu_3\mu_4}C^{\varphi D} \\
& + 4iC^{\varphi W}(p_3^{\mu_4}p_4^{\mu_3} - p_3 \cdot p_4\eta_{\mu_3\mu_4}) + 4iC^{\varphi\widetilde{W}}p_3^{\alpha_1}p_4^{\beta_1}\epsilon_{\mu_3\mu_4\alpha_1\beta_1}
\end{aligned}$$



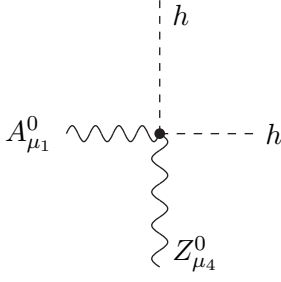
$$\begin{aligned}
& + \frac{i\bar{g}^2}{2}\eta_{\mu_3\mu_4} + i\bar{g}^2v^2\eta_{\mu_3\mu_4}C^{\varphi\Box} - \frac{1}{4}i\bar{g}^2v^2\eta_{\mu_3\mu_4}C^{\varphi D} \\
& + 4iC^{\varphi W}(p_3^{\mu_4}p_4^{\mu_3} - p_3 \cdot p_4\eta_{\mu_3\mu_4}) + 4iC^{\varphi\widetilde{W}}p_3^{\alpha_1}p_4^{\beta_1}\epsilon_{\mu_3\mu_4\alpha_1\beta_1}
\end{aligned}$$



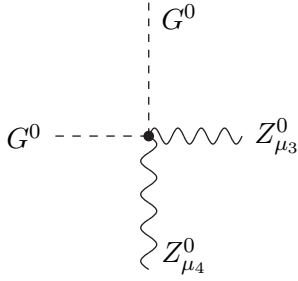
$$\begin{aligned}
& - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}C^{\varphi B}(p_1^{\mu_4}p_4^{\mu_1} - p_1 \cdot p_4\eta_{\mu_1\mu_4}) - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}C^{\varphi\widetilde{B}}p_1^{\alpha_1}p_4^{\beta_1}\epsilon_{\mu_1\mu_4\alpha_1\beta_1} \\
& + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}C^{\varphi W}(p_1^{\mu_4}p_4^{\mu_1} - p_1 \cdot p_4\eta_{\mu_1\mu_4}) \\
& + \frac{2i(\bar{g}'^2 - \bar{g}^2)}{\bar{g}^2 + \bar{g}'^2}C^{\varphi WB}(p_1^{\mu_4}p_4^{\mu_1} - p_1 \cdot p_4\eta_{\mu_1\mu_4}) \\
& + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}C^{\varphi\widetilde{W}}p_1^{\alpha_1}p_4^{\beta_1}\epsilon_{\mu_1\mu_4\alpha_1\beta_1} + \frac{2i(\bar{g}'^2 - \bar{g}^2)}{\bar{g}^2 + \bar{g}'^2}C^{\varphi\widetilde{WB}}p_1^{\alpha_1}p_4^{\beta_1}\epsilon_{\mu_1\mu_4\alpha_1\beta_1}
\end{aligned}$$



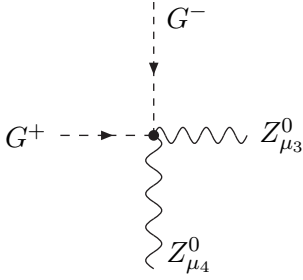
$$\begin{aligned}
& - \frac{i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}\eta_{\mu_1\mu_4} - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}C^{\varphi B}(p_1^{\mu_4}p_4^{\mu_1} - p_1 \cdot p_4\eta_{\mu_1\mu_4}) \\
& - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}C^{\varphi\widetilde{B}}p_1^{\alpha_1}p_4^{\beta_1}\epsilon_{\mu_1\mu_4\alpha_1\beta_1} - \frac{1}{2}i\bar{g}\bar{g}'v^2\eta_{\mu_1\mu_4}C^{\varphi D} \\
& + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}C^{\varphi W}(p_1^{\mu_4}p_4^{\mu_1} - p_1 \cdot p_4\eta_{\mu_1\mu_4}) \\
& + \frac{2i(\bar{g}'^2 - \bar{g}^2)}{(\bar{g}^2 + \bar{g}'^2)^2}C^{\varphi WB}\left(\eta_{\mu_1\mu_4}\left(\bar{g}'^2(p_1 \cdot p_4 + \bar{g}^2v^2) + \bar{g}^2p_1 \cdot p_4\right) \right. \\
& \left. - (\bar{g}^2 + \bar{g}'^2)p_1^{\mu_4}p_4^{\mu_1}\right) + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2}C^{\varphi\widetilde{W}}p_1^{\alpha_1}p_4^{\beta_1}\epsilon_{\mu_1\mu_4\alpha_1\beta_1} \\
& - \frac{2i(\bar{g}'^2 - \bar{g}^2)}{\bar{g}^2 + \bar{g}'^2}C^{\varphi\widetilde{WB}}p_1^{\alpha_1}p_4^{\beta_1}\epsilon_{\mu_1\mu_4\alpha_1\beta_1}
\end{aligned}$$



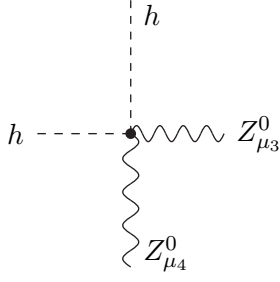
$$\begin{aligned}
& -\frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi B} (p_1^{\mu_4} p_4^{\mu_1} - p_1 \cdot p_4 \eta_{\mu_1 \mu_4}) - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{B}} p_1^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_1 \mu_4 \alpha_1 \beta_1} \\
& + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi W} (p_1^{\mu_4} p_4^{\mu_1} - p_1 \cdot p_4 \eta_{\mu_1 \mu_4}) \\
& + \frac{2i(\bar{g}'^2 - \bar{g}^2)}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (p_1^{\mu_4} p_4^{\mu_1} - p_1 \cdot p_4 \eta_{\mu_1 \mu_4}) \\
& + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}} p_1^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_1 \mu_4 \alpha_1 \beta_1} + \frac{2i(\bar{g}'^2 - \bar{g}^2)}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W} B} p_1^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_1 \mu_4 \alpha_1 \beta_1}
\end{aligned}$$



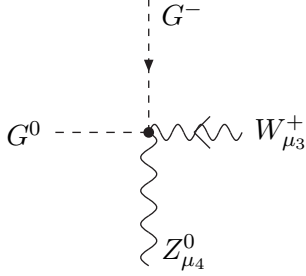
$$\begin{aligned}
& + \frac{i}{2} (\bar{g}^2 + \bar{g}'^2) \eta_{\mu_3 \mu_4} + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi B} (p_3^{\mu_4} p_4^{\mu_3} - p_3 \cdot p_4 \eta_{\mu_3 \mu_4}) \\
& + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{B}} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3 \mu_4 \alpha_1 \beta_1} + \frac{iv^2}{4} (\bar{g}^2 + \bar{g}'^2) \eta_{\mu_3 \mu_4} C^{\varphi D} \\
& + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi W} (p_3^{\mu_4} p_4^{\mu_3} - p_3 \cdot p_4 \eta_{\mu_3 \mu_4}) \\
& + \frac{i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} \left( \eta_{\mu_3 \mu_4} (-4p_3 \cdot p_4 + \bar{g}^2 v^2 + \bar{g}'^2 v^2) + 4p_3^{\mu_4} p_4^{\mu_3} \right) \\
& + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3 \mu_4 \alpha_1 \beta_1} + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W} B} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3 \mu_4 \alpha_1 \beta_1}
\end{aligned}$$



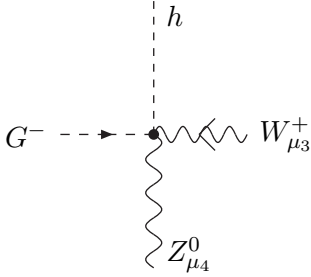
$$\begin{aligned}
& + \frac{i(\bar{g}'^2 - \bar{g}^2)^2}{2(\bar{g}^2 + \bar{g}'^2)} \eta_{\mu_3 \mu_4} + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi B} (p_3^{\mu_4} p_4^{\mu_3} - p_3 \cdot p_4 \eta_{\mu_3 \mu_4}) \\
& + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{B}} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3 \mu_4 \alpha_1 \beta_1} + \frac{1}{2} iv^2 (\bar{g}'^2 - \bar{g}^2) \eta_{\mu_3 \mu_4} C^{\varphi D} \\
& + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi W} (p_3^{\mu_4} p_4^{\mu_3} - p_3 \cdot p_4 \eta_{\mu_3 \mu_4}) \\
& - \frac{i\bar{g}\bar{g}'}{(\bar{g}^2 + \bar{g}'^2)^2} C^{\varphi WB} \left( \eta_{\mu_3 \mu_4} (-2\bar{g}'^2 (2p_3 \cdot p_4 + \bar{g}^2 v^2) \right. \\
& \left. - 4\bar{g}^2 p_3 \cdot p_4 + \bar{g}^4 v^2 + \bar{g}'^4 v^2) + 4(\bar{g}^2 + \bar{g}'^2) p_3^{\mu_4} p_4^{\mu_3} \right) \\
& + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3 \mu_4 \alpha_1 \beta_1} - \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W} B} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3 \mu_4 \alpha_1 \beta_1}
\end{aligned}$$



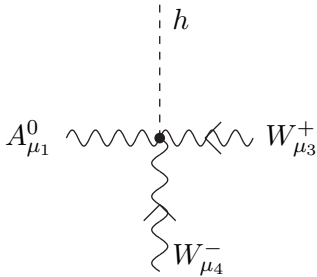
$$\begin{aligned}
& + \frac{i}{2} (\bar{g}^2 + \bar{g}'^2) \eta_{\mu_3\mu_4} + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi B} (p_3^{\mu_4} p_4^{\mu_3} - p_3 \cdot p_4 \eta_{\mu_3\mu_4}) \\
& + iv^2 (\bar{g}^2 + \bar{g}'^2) \eta_{\mu_3\mu_4} C^{\varphi \square} + \frac{4i\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{B}} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3\mu_4\alpha_1\beta_1} \\
& + \frac{5iv^2}{4} (\bar{g}^2 + \bar{g}'^2) \eta_{\mu_3\mu_4} C^{\varphi D} + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi W} (p_3^{\mu_4} p_4^{\mu_3} - p_3 \cdot p_4 \eta_{\mu_3\mu_4}) \\
& + \frac{i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} \left( \eta_{\mu_3\mu_4} \left( -4p_3 \cdot p_4 + \bar{g}^2 v^2 + \bar{g}'^2 v^2 \right) + 4p_3^{\mu_4} p_4^{\mu_3} \right) \\
& + \frac{4i\bar{g}^2}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3\mu_4\alpha_1\beta_1} + \frac{4i\bar{g}\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \tilde{W}B} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3\mu_4\alpha_1\beta_1}
\end{aligned}$$



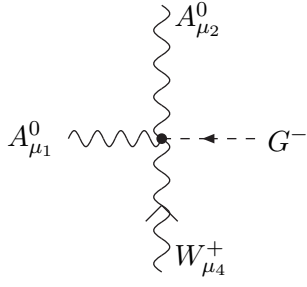
$$\begin{aligned}
& + \frac{\bar{g}\bar{g}'^2}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_3\mu_4} + \frac{\bar{g}v^2}{8\sqrt{\bar{g}^2 + \bar{g}'^2}} (2\bar{g}^2 + \bar{g}'^2) \eta_{\mu_3\mu_4} C^{\varphi D} \\
& + \frac{\bar{g}'}{2(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi WB} \left( \eta_{\mu_3\mu_4} \left( -4\bar{g}^2 p_3 \cdot p_4 - 4\bar{g}'^2 p_3 \cdot p_4 + \bar{g}^4 v^2 \right) \right. \\
& \left. + 4(\bar{g}^2 + \bar{g}'^2) p_3^{\mu_4} p_4^{\mu_3} \right) + \frac{2\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \tilde{W}B} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3\mu_4\alpha_1\beta_1}
\end{aligned}$$



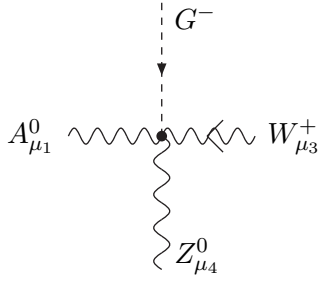
$$\begin{aligned}
& - \frac{i\bar{g}\bar{g}'^2}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_3\mu_4} - \frac{i\bar{g}\bar{g}'^2 v^2}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_3\mu_4} C^{\varphi \square} \\
& - \frac{i\bar{g}v^2}{8\sqrt{\bar{g}^2 + \bar{g}'^2}} (6\bar{g}^2 + 5\bar{g}'^2) \eta_{\mu_3\mu_4} C^{\varphi D} \\
& - \frac{i\bar{g}'}{2(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi WB} \left( \eta_{\mu_3\mu_4} \left( -4\bar{g}^2 p_3 \cdot p_4 - 4\bar{g}'^2 p_3 \cdot p_4 + \bar{g}^4 v^2 \right) \right. \\
& \left. + 4(\bar{g}^2 + \bar{g}'^2) p_3^{\mu_4} p_4^{\mu_3} \right) - \frac{2i\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \tilde{W}B} p_3^{\alpha_1} p_4^{\beta_1} \epsilon_{\mu_3\mu_4\alpha_1\beta_1}
\end{aligned}$$



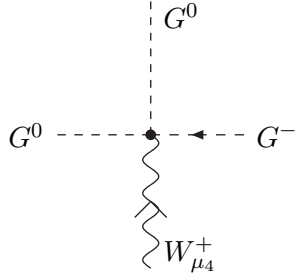
$$\begin{aligned}
& - \frac{4i\bar{g}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi W} (\eta_{\mu_1\mu_3} p_1^{\mu_4} - \eta_{\mu_1\mu_3} p_3^{\mu_4} - \eta_{\mu_1\mu_4} p_1^{\mu_3} + \eta_{\mu_1\mu_4} p_4^{\mu_3} \\
& + \eta_{\mu_3\mu_4} p_3^{\mu_1} - \eta_{\mu_3\mu_4} p_4^{\mu_1}) + \frac{2i\bar{g}^2 v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi WB} (\eta_{\mu_1\mu_3} p_1^{\mu_4} - \eta_{\mu_1\mu_4} p_1^{\mu_3}) \\
& + \frac{4i\bar{g}\bar{g}'v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \tilde{W}} (p_1^{\alpha_1} + p_3^{\alpha_1} + p_4^{\alpha_1}) \epsilon_{\mu_1\mu_4\mu_3\alpha_1} \\
& - \frac{2i\bar{g}^2 v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \tilde{W}B} p_1^{\alpha_1} \epsilon_{\mu_1\mu_4\mu_3\alpha_1}
\end{aligned}$$



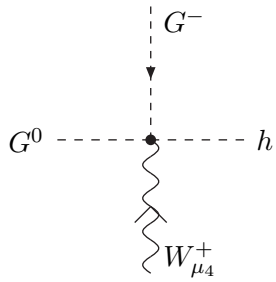
$$\begin{aligned}
& -\frac{2i\bar{g}^2\bar{g}'v}{\bar{g}^2+\bar{g}'^2}C^{\varphi WB}(\eta_{\mu_1\mu_2}p_1^{\mu_4}+\eta_{\mu_1\mu_2}p_2^{\mu_4}-\eta_{\mu_1\mu_4}p_1^{\mu_2}-\eta_{\mu_2\mu_4}p_2^{\mu_1}) \\
& -\frac{2i\bar{g}^2\bar{g}'v}{\bar{g}^2+\bar{g}'^2}C^{\varphi\widetilde{W}B}(p_1^{\alpha_1}-p_2^{\alpha_1})\epsilon_{\mu_1\mu_2\mu_4\alpha_1}
\end{aligned}$$



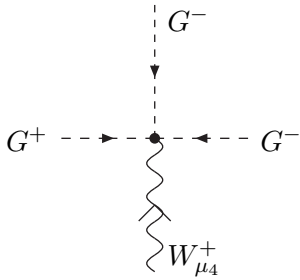
$$\begin{aligned}
& +\frac{2i\bar{g}v}{\bar{g}^2+\bar{g}'^2}C^{\varphi WB}\left(\bar{g}^2\eta_{\mu_1\mu_3}p_1^{\mu_4}-\bar{g}^2\eta_{\mu_1\mu_4}p_1^{\mu_3}+\bar{g}'^2(\eta_{\mu_1\mu_4}p_4^{\mu_3}-\eta_{\mu_3\mu_4}p_4^{\mu_1})\right) \\
& -\frac{2i\bar{g}v}{\bar{g}^2+\bar{g}'^2}C^{\varphi\widetilde{W}B}\epsilon_{\mu_1\mu_4\mu_3\alpha_1}\left(\bar{g}^2p_1^{\alpha_1}+\bar{g}'^2p_4^{\alpha_1}\right)
\end{aligned}$$



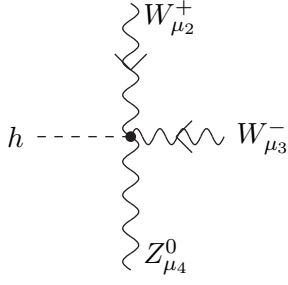
$$+\frac{i\bar{g}v}{2}C^{\varphi D}(p_1^{\mu_4}+p_2^{\mu_4})$$



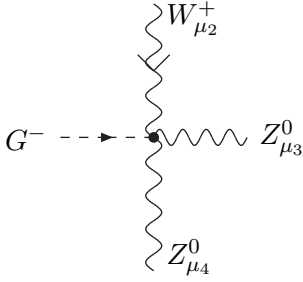
$$+\frac{\bar{g}v}{2}C^{\varphi D}(2p_1^{\mu_4}-p_3^{\mu_4})$$



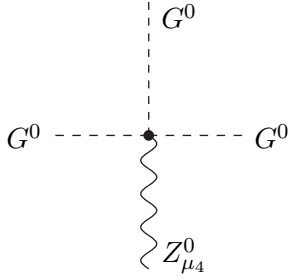
$$-\frac{1}{2}i\bar{g}vC^{\varphi D}(2p_1^{\mu_4}-p_2^{\mu_4}-p_3^{\mu_4})$$



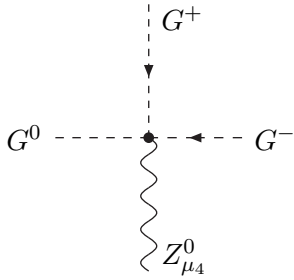
$$\begin{aligned}
& -\frac{4i\bar{g}^2 v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi W} (\eta_{\mu_2 \mu_3} p_2^{\mu_4} - \eta_{\mu_2 \mu_3} p_3^{\mu_4} - \eta_{\mu_2 \mu_4} p_2^{\mu_3} + \eta_{\mu_2 \mu_4} p_4^{\mu_3} \\
& + \eta_{\mu_3 \mu_4} p_3^{\mu_2} - \eta_{\mu_3 \mu_4} p_4^{\mu_2}) - \frac{2i\bar{g}\bar{g}' v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi WB} (\eta_{\mu_2 \mu_4} p_4^{\mu_3} - \eta_{\mu_3 \mu_4} p_4^{\mu_2}) \\
& - \frac{4i\bar{g}^2 v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}} (p_2^{\alpha_1} + p_3^{\alpha_1} + p_4^{\alpha_1}) \epsilon_{\mu_4 \mu_2 \mu_3 \alpha_1} \\
& - \frac{2i\bar{g}\bar{g}' v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W} B} p_4^{\alpha_1} \epsilon_{\mu_4 \mu_2 \mu_3 \alpha_1}
\end{aligned}$$



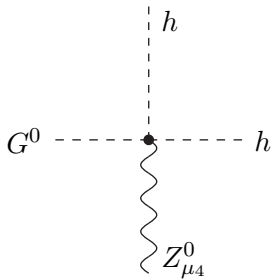
$$\begin{aligned}
& -\frac{2i\bar{g}^2 \bar{g}' v}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (\eta_{\mu_2 \mu_3} p_3^{\mu_4} + \eta_{\mu_2 \mu_4} p_4^{\mu_3} - \eta_{\mu_3 \mu_4} (p_3^{\mu_2} + p_4^{\mu_2})) \\
& - \frac{2i\bar{g}^2 \bar{g}' v}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \widetilde{W} B} (p_3^{\alpha_1} - p_4^{\alpha_1}) \epsilon_{\mu_3 \mu_2 \mu_4 \alpha_1}
\end{aligned}$$



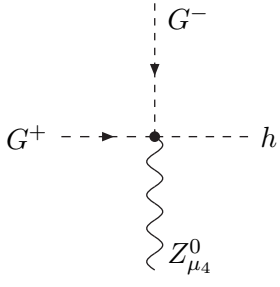
$$-\frac{1}{2} v \sqrt{\bar{g}^2 + \bar{g}'^2} C^{\varphi D} (p_1^{\mu_4} + p_2^{\mu_4} + p_3^{\mu_4})$$



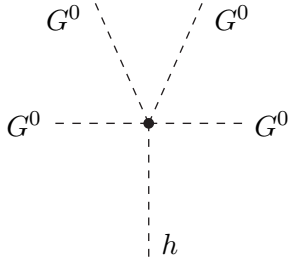
$$-\frac{v (\bar{g}'^2 - \bar{g}^2)}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi D} p_1^{\mu_4}$$



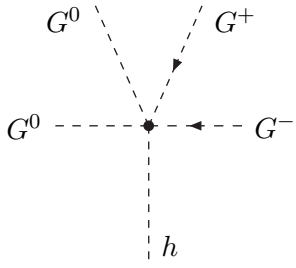
$$-\frac{1}{2} v \sqrt{\bar{g}^2 + \bar{g}'^2} C^{\varphi D} (3p_1^{\mu_4} - p_2^{\mu_4} - p_3^{\mu_4})$$



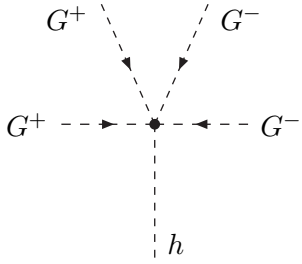
$$+\frac{1}{2}iv\sqrt{\bar{g}^2+\bar{g}'^2}C^{\varphi D}(p_1^{\mu_4}-p_2^{\mu_4})$$



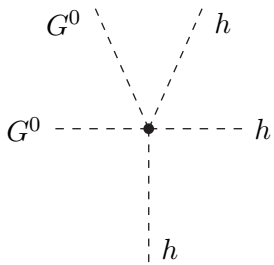
$$+18ivC^{\varphi}$$



$$+6ivC^{\varphi}$$

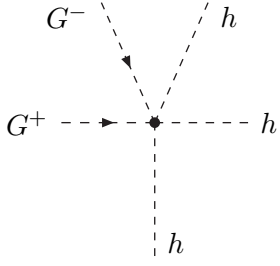


$$+12ivC^{\varphi}$$

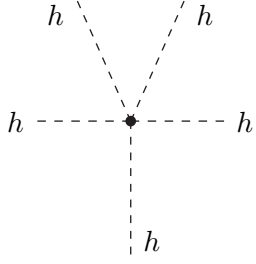


$$+18ivC^{\varphi}$$

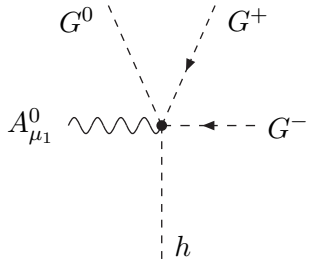




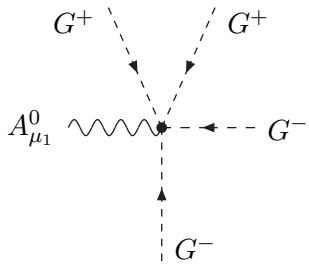
$$+18ivC^\varphi$$



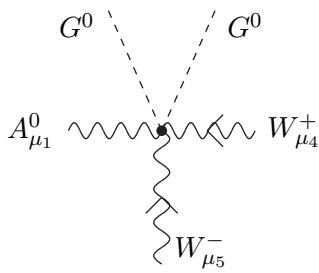
$$+90ivC^\varphi$$



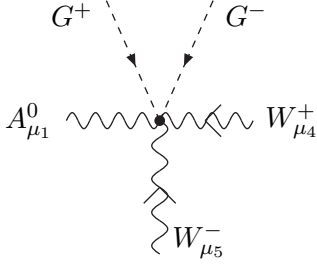
$$+\frac{\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi D}(p_2^{\mu_1}-p_5^{\mu_1})$$



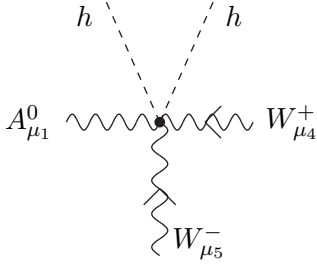
$$-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi D}(p_2^{\mu_1}+p_3^{\mu_1}-p_4^{\mu_1}-p_5^{\mu_1})$$



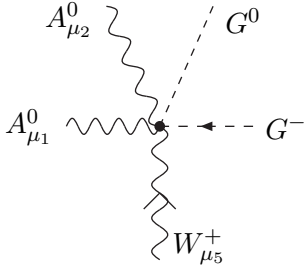
$$\begin{aligned} & -\frac{4i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi W}(\eta_{\mu_1\mu_4}p_1^{\mu_5}-\eta_{\mu_1\mu_4}p_4^{\mu_5}-\eta_{\mu_1\mu_5}p_1^{\mu_4}+\eta_{\mu_1\mu_5}p_5^{\mu_4} \\ & +\eta_{\mu_4\mu_5}p_4^{\mu_1}-\eta_{\mu_4\mu_5}p_5^{\mu_1})+\frac{2i\bar{g}^2}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi WB}(\eta_{\mu_1\mu_4}p_1^{\mu_5}-\eta_{\mu_1\mu_5}p_1^{\mu_4}) \\ & +\frac{4i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi\widetilde{W}}(p_1^{\alpha_1}+p_4^{\alpha_1}+p_5^{\alpha_1})\epsilon_{\mu_1\mu_5\mu_4\alpha_1} \\ & -\frac{2i\bar{g}^2}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi\widetilde{W}B}p_1^{\alpha_1}\epsilon_{\mu_1\mu_5\mu_4\alpha_1} \end{aligned}$$



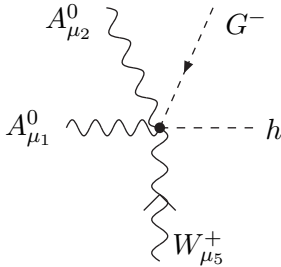
$$\begin{aligned}
& -\frac{4i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi W} (\eta_{\mu_1\mu_4} p_1^{\mu_5} - \eta_{\mu_1\mu_4} p_4^{\mu_5} - \eta_{\mu_1\mu_5} p_1^{\mu_4} + \eta_{\mu_1\mu_5} p_5^{\mu_4}) \\
& + \eta_{\mu_4\mu_5} p_4^{\mu_1} - \eta_{\mu_4\mu_5} p_5^{\mu_1}) - \frac{2i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi WB} (\eta_{\mu_1\mu_4} p_1^{\mu_5} - \eta_{\mu_1\mu_5} p_1^{\mu_4}) \\
& + \frac{4i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}} (p_1^{\alpha_1} + p_4^{\alpha_1} + p_5^{\alpha_1}) \epsilon_{\mu_1\mu_5\mu_4\alpha_1} \\
& + \frac{2i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W} B} p_1^{\alpha_1} \epsilon_{\mu_1\mu_5\mu_4\alpha_1}
\end{aligned}$$



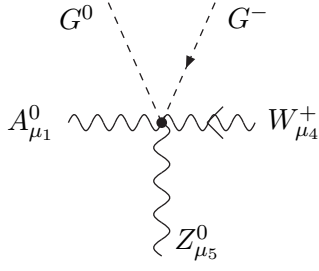
$$\begin{aligned}
& -\frac{4i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi W} (\eta_{\mu_1\mu_4} p_1^{\mu_5} - \eta_{\mu_1\mu_4} p_4^{\mu_5} - \eta_{\mu_1\mu_5} p_1^{\mu_4} + \eta_{\mu_1\mu_5} p_5^{\mu_4}) \\
& + \eta_{\mu_4\mu_5} p_4^{\mu_1} - \eta_{\mu_4\mu_5} p_5^{\mu_1}) + \frac{2i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi WB} (\eta_{\mu_1\mu_4} p_1^{\mu_5} - \eta_{\mu_1\mu_5} p_1^{\mu_4}) \\
& + \frac{4i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}} (p_1^{\alpha_1} + p_4^{\alpha_1} + p_5^{\alpha_1}) \epsilon_{\mu_1\mu_5\mu_4\alpha_1} \\
& - \frac{2i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W} B} p_1^{\alpha_1} \epsilon_{\mu_1\mu_5\mu_4\alpha_1}
\end{aligned}$$



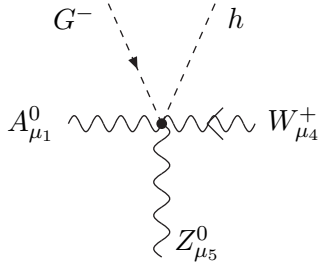
$$\begin{aligned}
& + \frac{2\bar{g}^2\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (\eta_{\mu_1\mu_2} p_1^{\mu_5} + \eta_{\mu_1\mu_2} p_2^{\mu_5} - \eta_{\mu_1\mu_5} p_1^{\mu_2} - \eta_{\mu_2\mu_5} p_2^{\mu_1}) \\
& + \frac{2\bar{g}^2\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \widetilde{W} B} (p_1^{\alpha_1} - p_2^{\alpha_1}) \epsilon_{\mu_1\mu_2\mu_5\alpha_1}
\end{aligned}$$



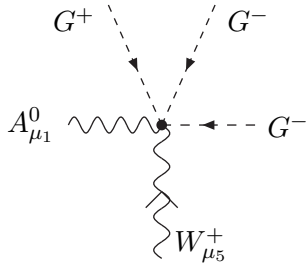
$$\begin{aligned}
& -\frac{2i\bar{g}^2\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (\eta_{\mu_1\mu_2} p_1^{\mu_5} + \eta_{\mu_1\mu_2} p_2^{\mu_5} - \eta_{\mu_1\mu_5} p_1^{\mu_2} - \eta_{\mu_2\mu_5} p_2^{\mu_1}) \\
& - \frac{2i\bar{g}^2\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \widetilde{W} B} (p_1^{\alpha_1} - p_2^{\alpha_1}) \epsilon_{\mu_1\mu_2\mu_5\alpha_1}
\end{aligned}$$



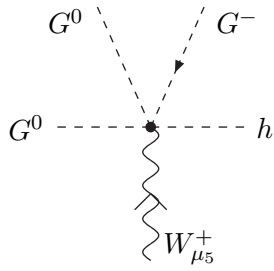
$$-\frac{2\bar{g}}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} \left( \bar{g}^2 \eta_{\mu_1 \mu_4} p_1^{\mu_5} - \bar{g}^2 \eta_{\mu_1 \mu_5} p_1^{\mu_4} + \bar{g}'^2 (\eta_{\mu_1 \mu_5} p_5^{\mu_4} - \eta_{\mu_4 \mu_5} p_5^{\mu_1}) \right) \\ + \frac{2\bar{g}}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \widetilde{W} B} \epsilon_{\mu_1 \mu_5 \mu_4 \alpha_1} \left( \bar{g}^2 p_1^{\alpha_1} + \bar{g}'^2 p_5^{\alpha_1} \right)$$



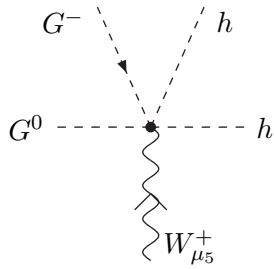
$$+\frac{2i\bar{g}}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} \left( \bar{g}^2 \eta_{\mu_1 \mu_4} p_1^{\mu_5} - \bar{g}^2 \eta_{\mu_1 \mu_5} p_1^{\mu_4} + \bar{g}'^2 (\eta_{\mu_1 \mu_5} p_5^{\mu_4} - \eta_{\mu_4 \mu_5} p_5^{\mu_1}) \right) \\ - \frac{2i\bar{g}}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \widetilde{W} B} \epsilon_{\mu_1 \mu_5 \mu_4 \alpha_1} \left( \bar{g}^2 p_1^{\alpha_1} + \bar{g}'^2 p_5^{\alpha_1} \right)$$



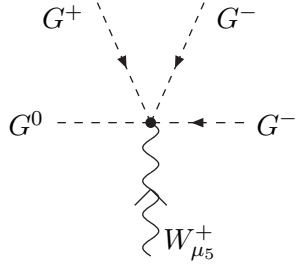
$$+\frac{2i\bar{g}^2 \bar{g}' v}{\sqrt{\bar{g}^2 + \bar{g}'^2}} \eta_{\mu_1 \mu_5} C^{\varphi D}$$



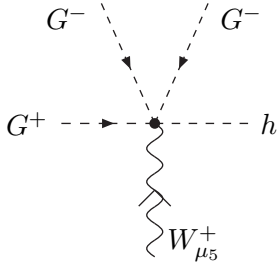
$$+\frac{i\bar{g}}{2} C^{\varphi D} (p_1^{\mu_5} + p_2^{\mu_5} - 2p_4^{\mu_5})$$



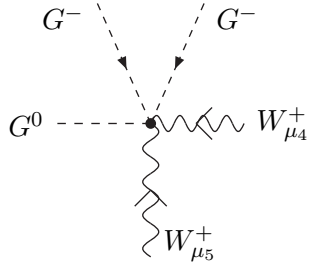
$$+\frac{\bar{g}}{2} C^{\varphi D} (2p_1^{\mu_5} - p_3^{\mu_5} - p_4^{\mu_5})$$



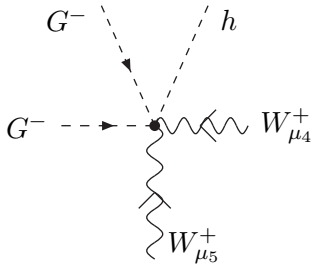
$$+\frac{\bar{g}}{2}C^{\varphi D}(2p_2^{\mu_5}-p_3^{\mu_5}-p_4^{\mu_5})$$



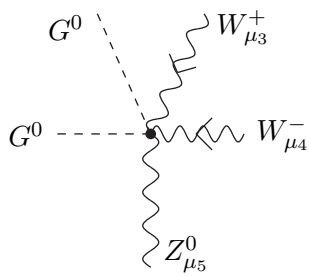
$$-\frac{i\bar{g}}{2}C^{\varphi D}(2p_1^{\mu_5}-p_2^{\mu_5}-p_3^{\mu_5})$$



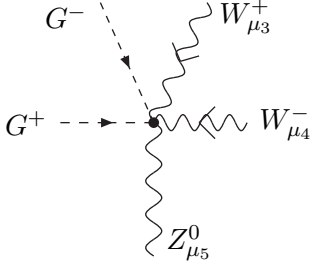
$$-2\bar{g}^2v\eta_{\mu_4\mu_5}C^{\varphi D}$$



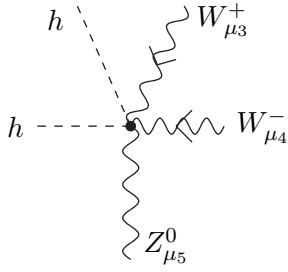
$$+2i\bar{g}^2v\eta_{\mu_4\mu_5}C^{\varphi D}$$



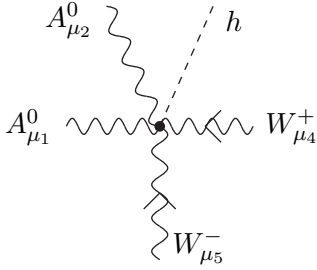
$$\begin{aligned} & -\frac{4i\bar{g}^2}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi W}(\eta_{\mu_3\mu_4}p_3^{\mu_5}-\eta_{\mu_3\mu_4}p_4^{\mu_5}-\eta_{\mu_3\mu_5}p_3^{\mu_4}+\eta_{\mu_3\mu_5}p_5^{\mu_4} \\ & +\eta_{\mu_4\mu_5}p_4^{\mu_3}-\eta_{\mu_4\mu_5}p_5^{\mu_3})-\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi WB}(\eta_{\mu_3\mu_5}p_5^{\mu_4}-\eta_{\mu_4\mu_5}p_5^{\mu_3}) \\ & -\frac{4i\bar{g}^2}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi\widetilde{W}}(p_3^{\alpha_1}+p_4^{\alpha_1}+p_5^{\alpha_1})\epsilon_{\mu_5\mu_3\mu_4\alpha_1} \\ & -\frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi\widetilde{WB}}p_5^{\alpha_1}\epsilon_{\mu_5\mu_3\mu_4\alpha_1} \end{aligned}$$



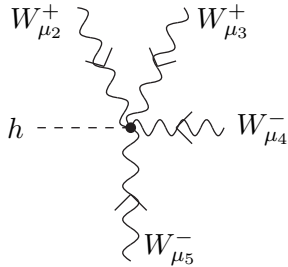
$$\begin{aligned}
& -\frac{4i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi W} (\eta_{\mu_3\mu_4} p_3^{\mu_5} - \eta_{\mu_3\mu_4} p_4^{\mu_5} - \eta_{\mu_3\mu_5} p_3^{\mu_4} + \eta_{\mu_3\mu_5} p_5^{\mu_4} \\
& + \eta_{\mu_4\mu_5} p_4^{\mu_3} - \eta_{\mu_4\mu_5} p_5^{\mu_3}) + \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi WB} (\eta_{\mu_3\mu_5} p_5^{\mu_4} - \eta_{\mu_4\mu_5} p_5^{\mu_3}) \\
& - \frac{4i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}} (p_3^{\alpha_1} + p_4^{\alpha_1} + p_5^{\alpha_1}) \epsilon_{\mu_5\mu_3\mu_4\alpha_1} \\
& + \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}_B} p_5^{\alpha_1} \epsilon_{\mu_5\mu_3\mu_4\alpha_1}
\end{aligned}$$



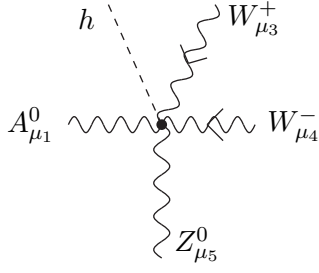
$$\begin{aligned}
& -\frac{4i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi W} (\eta_{\mu_3\mu_4} p_3^{\mu_5} - \eta_{\mu_3\mu_4} p_4^{\mu_5} - \eta_{\mu_3\mu_5} p_3^{\mu_4} + \eta_{\mu_3\mu_5} p_5^{\mu_4} \\
& + \eta_{\mu_4\mu_5} p_4^{\mu_3} - \eta_{\mu_4\mu_5} p_5^{\mu_3}) - \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi WB} (\eta_{\mu_3\mu_5} p_5^{\mu_4} - \eta_{\mu_4\mu_5} p_5^{\mu_3}) \\
& - \frac{4i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}} (p_3^{\alpha_1} + p_4^{\alpha_1} + p_5^{\alpha_1}) \epsilon_{\mu_5\mu_3\mu_4\alpha_1} \\
& - \frac{2i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi \widetilde{W}_B} p_5^{\alpha_1} \epsilon_{\mu_5\mu_3\mu_4\alpha_1}
\end{aligned}$$



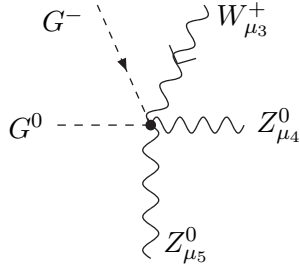
$$-\frac{4i\bar{g}^2\bar{g}'^2v}{\bar{g}^2 + \bar{g}'^2} (\eta_{\mu_1\mu_5}\eta_{\mu_2\mu_4} + \eta_{\mu_1\mu_4}\eta_{\mu_2\mu_5} - 2\eta_{\mu_1\mu_2}\eta_{\mu_4\mu_5}) C^{\varphi W}$$



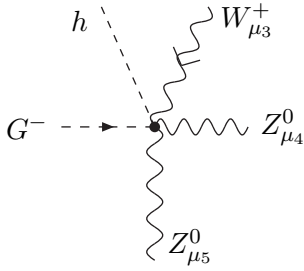
$$+4i\bar{g}^2v (\eta_{\mu_2\mu_5}\eta_{\mu_3\mu_4} + \eta_{\mu_2\mu_4}\eta_{\mu_3\mu_5} - 2\eta_{\mu_2\mu_3}\eta_{\mu_4\mu_5}) C^{\varphi W}$$



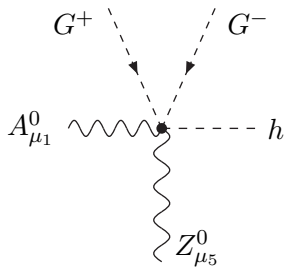
$$+ \frac{4i\bar{g}^3\bar{g}'v}{\bar{g}^2 + \bar{g}'^2} (2\eta_{\mu_1\mu_5}\eta_{\mu_3\mu_4} - \eta_{\mu_1\mu_4}\eta_{\mu_3\mu_5} - \eta_{\mu_1\mu_3}\eta_{\mu_4\mu_5}) C^{\varphi W}$$



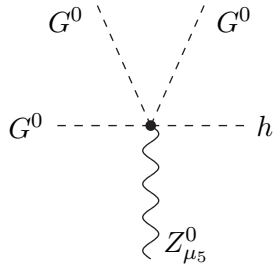
$$+ \frac{2\bar{g}^2\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (\eta_{\mu_3\mu_4}p_4^{\mu_5} + \eta_{\mu_3\mu_5}p_5^{\mu_4} - \eta_{\mu_4\mu_5}(p_4^{\mu_3} + p_5^{\mu_3})) \\ + \frac{2\bar{g}^2\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \widetilde{WB}} (p_4^{\alpha_1} - p_5^{\alpha_1}) \epsilon_{\mu_4\mu_3\mu_5\alpha_1}$$



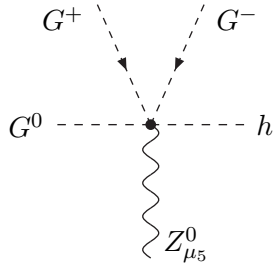
$$- \frac{2i\bar{g}^2\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi WB} (\eta_{\mu_3\mu_4}p_4^{\mu_5} + \eta_{\mu_3\mu_5}p_5^{\mu_4} - \eta_{\mu_4\mu_5}(p_4^{\mu_3} + p_5^{\mu_3})) \\ - \frac{2i\bar{g}^2\bar{g}'}{\bar{g}^2 + \bar{g}'^2} C^{\varphi \widetilde{WB}} (p_4^{\alpha_1} - p_5^{\alpha_1}) \epsilon_{\mu_4\mu_3\mu_5\alpha_1}$$



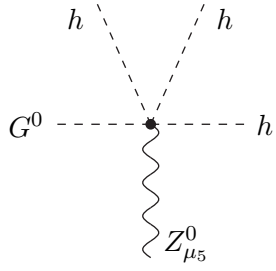
$$-i\bar{g}\bar{g}'v\eta_{\mu_1\mu_5}C^{\varphi D}$$



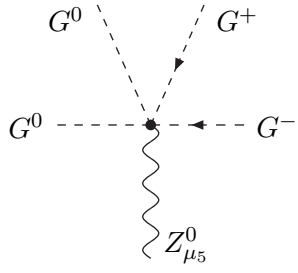
$$- \frac{1}{2} \sqrt{\bar{g}^2 + \bar{g}'^2} C^{\varphi D} (p_1^{\mu_5} + p_2^{\mu_5} + p_3^{\mu_5} - 3p_4^{\mu_5})$$



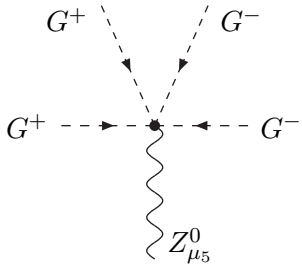
$$-\frac{\bar{g}'^2 - \bar{g}^2}{2\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi D} (p_1^{\mu_5} - p_4^{\mu_5})$$



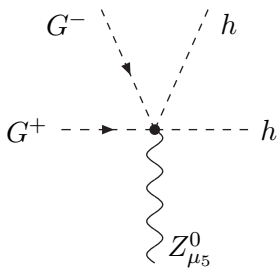
$$-\frac{1}{2}\sqrt{\bar{g}^2 + \bar{g}'^2} C^{\varphi D} (3p_1^{\mu_5} - p_2^{\mu_5} - p_3^{\mu_5} - p_4^{\mu_5})$$



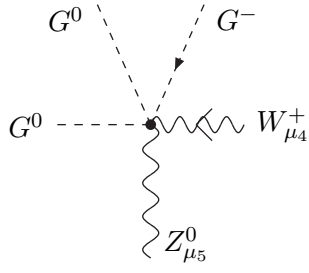
$$+\frac{1}{2}i\sqrt{\bar{g}^2 + \bar{g}'^2} C^{\varphi D} (p_3^{\mu_5} - p_4^{\mu_5})$$



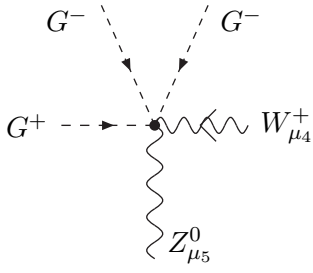
$$+\frac{i(\bar{g}'^2 - \bar{g}^2)}{\sqrt{\bar{g}^2 + \bar{g}'^2}} C^{\varphi D} (p_1^{\mu_5} + p_2^{\mu_5} - p_3^{\mu_5} - p_4^{\mu_5})$$



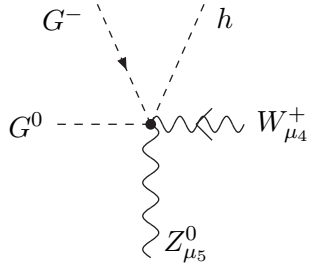
$$+\frac{1}{2}i\sqrt{\bar{g}^2 + \bar{g}'^2} C^{\varphi D} (p_1^{\mu_5} - p_2^{\mu_5})$$



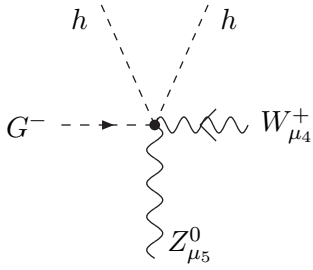
$$-\frac{1}{2}i\bar{g}v\sqrt{\bar{g}^2 + \bar{g}'^2}\eta_{\mu_4\mu_5}C^{\varphi D}$$



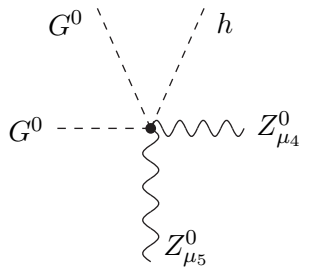
$$-\frac{i\bar{g}v\left(\bar{g}'^2 - \bar{g}^2\right)}{\sqrt{\bar{g}^2 + \bar{g}'^2}}\eta_{\mu_4\mu_5}C^{\varphi D}$$



$$+\frac{1}{2}\bar{g}v\sqrt{\bar{g}^2 + \bar{g}'^2}\eta_{\mu_4\mu_5}C^{\varphi D}$$

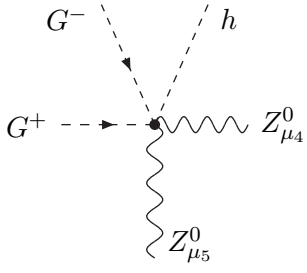


$$-\frac{3}{2}i\bar{g}v\sqrt{\bar{g}^2 + \bar{g}'^2}\eta_{\mu_4\mu_5}C^{\varphi D}$$

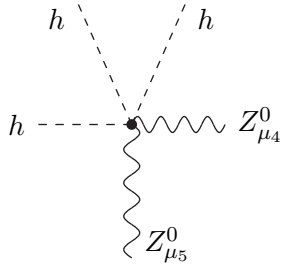


$$+iv\left(\bar{g}^2 + \bar{g}'^2\right)\eta_{\mu_4\mu_5}C^{\varphi D}$$

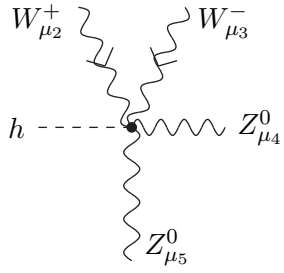




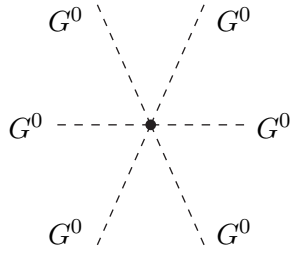
$$+iv \left( \bar{g}'^2 - \bar{g}^2 \right) \eta_{\mu_4 \mu_5} C^{\varphi D}$$



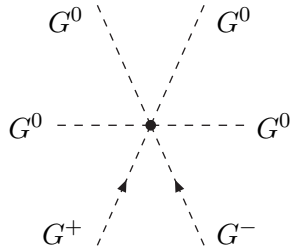
$$+3iv \left( \bar{g}^2 + \bar{g}'^2 \right) \eta_{\mu_4 \mu_5} C^{\varphi D}$$



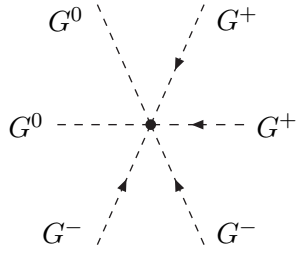
$$-\frac{4i\bar{g}^4 v}{\bar{g}^2 + \bar{g}'^2} (\eta_{\mu_2 \mu_5} \eta_{\mu_3 \mu_4} + \eta_{\mu_2 \mu_4} \eta_{\mu_3 \mu_5} - 2\eta_{\mu_2 \mu_3} \eta_{\mu_4 \mu_5}) C^{\varphi W}$$



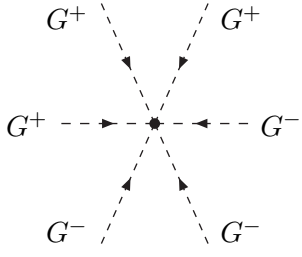
$$+90iC^{\varphi}$$



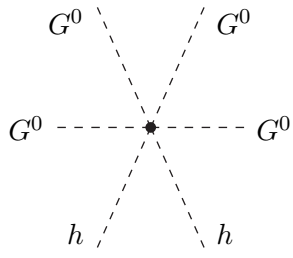
$$+18iC^{\varphi}$$



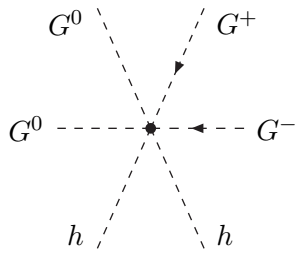
$$+12iC'\varphi$$



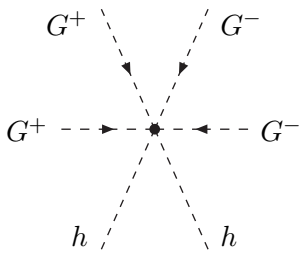
$$+36iC'\varphi$$



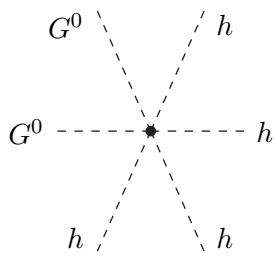
$$+18iC'\varphi$$



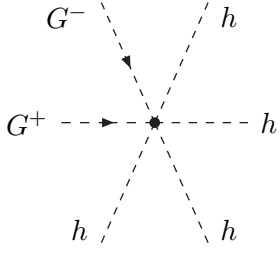
$$+6iC'\varphi$$



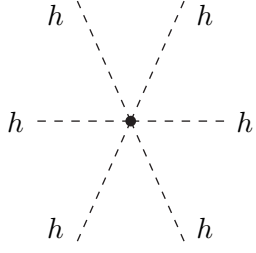
$$+12iC'\varphi$$



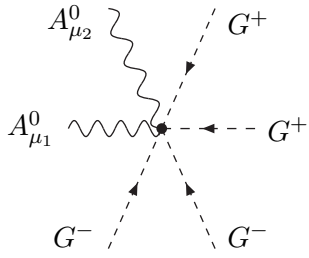
$$+18iC'\varphi$$



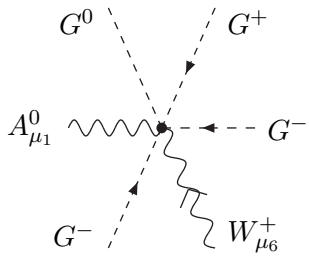
$$+18iC^\varphi$$



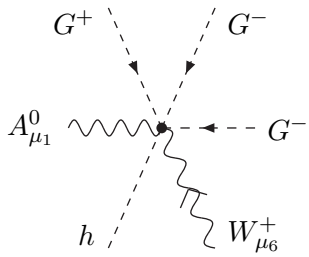
$$+90iC^\varphi$$



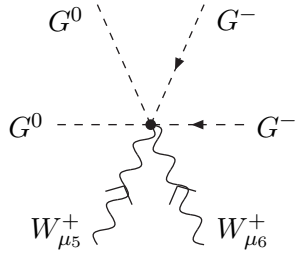
$$+\frac{8i\bar{g}^2\bar{g}'^2}{\bar{g}^2+\bar{g}'^2}\eta_{\mu_1\mu_2}C^{\varphi D}$$



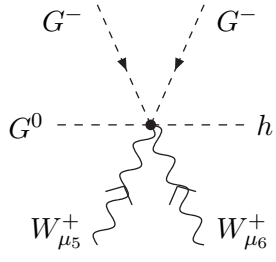
$$-\frac{2\bar{g}^2\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}\eta_{\mu_1\mu_6}C^{\varphi D}$$



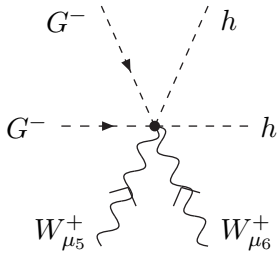
$$+\frac{2i\bar{g}^2\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}\eta_{\mu_1\mu_6}C^{\varphi D}$$



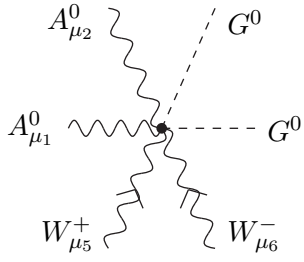
$$-2i\bar{g}^2\eta_{\mu_5\mu_6}C^{\varphi D}$$



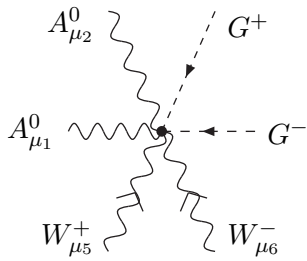
$$-2\bar{g}^2\eta_{\mu_5\mu_6}C^{\varphi D}$$



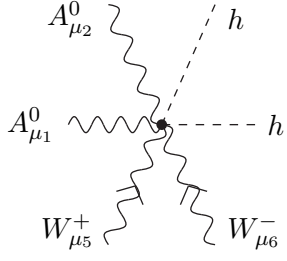
$$+2i\bar{g}^2\eta_{\mu_5\mu_6}C^{\varphi D}$$



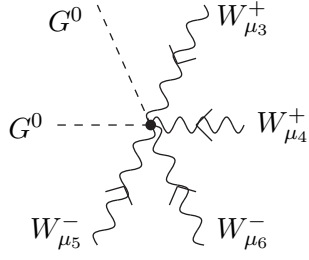
$$-\frac{4i\bar{g}^2\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2}(\eta_{\mu_1\mu_6}\eta_{\mu_2\mu_5} + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_6} - 2\eta_{\mu_1\mu_2}\eta_{\mu_5\mu_6})C^{\varphi W}$$



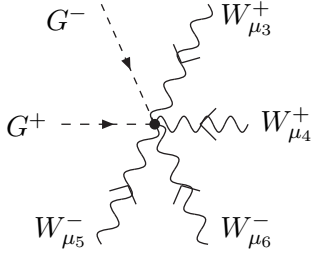
$$-\frac{4i\bar{g}^2\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2}(\eta_{\mu_1\mu_6}\eta_{\mu_2\mu_5} + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_6} - 2\eta_{\mu_1\mu_2}\eta_{\mu_5\mu_6})C^{\varphi W}$$



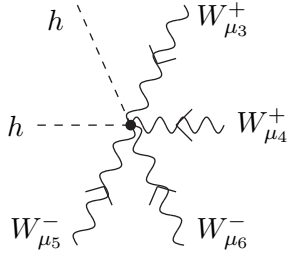
$$-\frac{4i\bar{g}^2\bar{g}'^2}{\bar{g}^2 + \bar{g}'^2} (\eta_{\mu_1\mu_6}\eta_{\mu_2\mu_5} + \eta_{\mu_1\mu_5}\eta_{\mu_2\mu_6} - 2\eta_{\mu_1\mu_2}\eta_{\mu_5\mu_6}) C^{\varphi W}$$



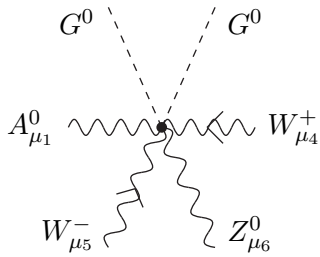
$$+4i\bar{g}^2 (\eta_{\mu_3\mu_6}\eta_{\mu_4\mu_5} + \eta_{\mu_3\mu_5}\eta_{\mu_4\mu_6} - 2\eta_{\mu_3\mu_4}\eta_{\mu_5\mu_6}) C^{\varphi W}$$



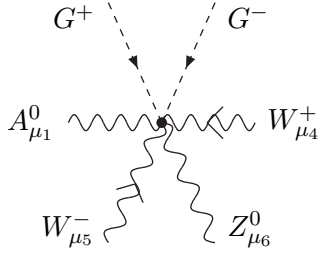
$$+4i\bar{g}^2 (\eta_{\mu_3\mu_6}\eta_{\mu_4\mu_5} + \eta_{\mu_3\mu_5}\eta_{\mu_4\mu_6} - 2\eta_{\mu_3\mu_4}\eta_{\mu_5\mu_6}) C^{\varphi W}$$



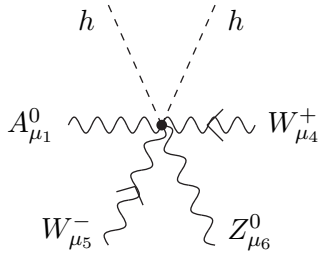
$$+4i\bar{g}^2 (\eta_{\mu_3\mu_6}\eta_{\mu_4\mu_5} + \eta_{\mu_3\mu_5}\eta_{\mu_4\mu_6} - 2\eta_{\mu_3\mu_4}\eta_{\mu_5\mu_6}) C^{\varphi W}$$



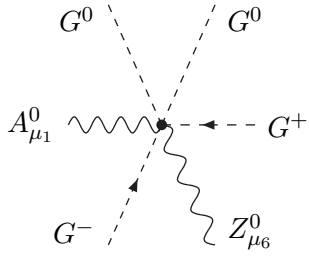
$$+\frac{4i\bar{g}^3\bar{g}'}{\bar{g}^2 + \bar{g}'^2} (2\eta_{\mu_1\mu_6}\eta_{\mu_4\mu_5} - \eta_{\mu_1\mu_5}\eta_{\mu_4\mu_6} - \eta_{\mu_1\mu_4}\eta_{\mu_5\mu_6}) C^{\varphi W}$$



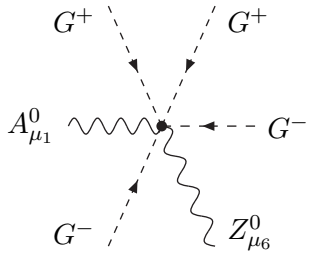
$$+ \frac{4i\bar{g}^3\bar{g}'}{\bar{g}^2 + \bar{g}'^2} (2\eta_{\mu_1\mu_6}\eta_{\mu_4\mu_5} - \eta_{\mu_1\mu_5}\eta_{\mu_4\mu_6} - \eta_{\mu_1\mu_4}\eta_{\mu_5\mu_6}) C^{\varphi W}$$



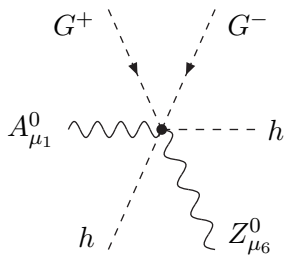
$$+ \frac{4i\bar{g}^3\bar{g}'}{\bar{g}^2 + \bar{g}'^2} (2\eta_{\mu_1\mu_6}\eta_{\mu_4\mu_5} - \eta_{\mu_1\mu_5}\eta_{\mu_4\mu_6} - \eta_{\mu_1\mu_4}\eta_{\mu_5\mu_6}) C^{\varphi W}$$



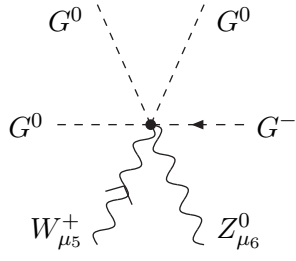
$$-i\bar{g}\bar{g}'\eta_{\mu_1\mu_6}C^{\varphi D}$$



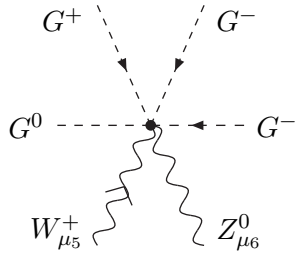
$$- \frac{4i\bar{g}\bar{g}'(\bar{g}'^2 - \bar{g}^2)}{\bar{g}^2 + \bar{g}'^2} \eta_{\mu_1\mu_6} C^{\varphi D}$$



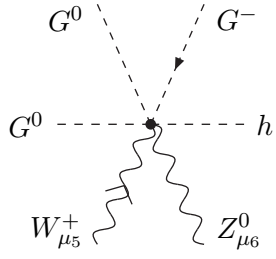
$$-i\bar{g}\bar{g}'\eta_{\mu_1\mu_6}C^{\varphi D}$$



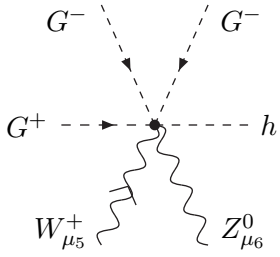
$$+\frac{3}{2}\bar{g}\sqrt{\bar{g}^2+\bar{g}'^2}\eta_{\mu_5\mu_6}C^{\varphi D}$$



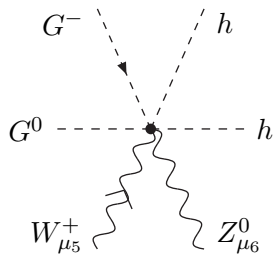
$$+\frac{\bar{g}\left(\bar{g}'^2-\bar{g}^2\right)}{\sqrt{\bar{g}^2+\bar{g}'^2}}\eta_{\mu_5\mu_6}C^{\varphi D}$$



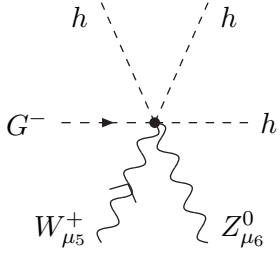
$$-\frac{1}{2}i\bar{g}\sqrt{\bar{g}^2+\bar{g}'^2}\eta_{\mu_5\mu_6}C^{\varphi D}$$



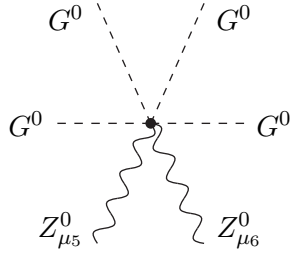
$$-\frac{i\bar{g}\left(\bar{g}'^2-\bar{g}^2\right)}{\sqrt{\bar{g}^2+\bar{g}'^2}}\eta_{\mu_5\mu_6}C^{\varphi D}$$



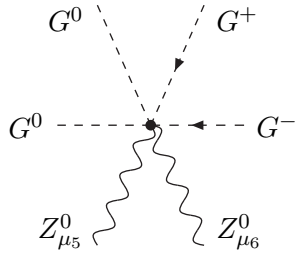
$$+\frac{1}{2}\bar{g}\sqrt{\bar{g}^2+\bar{g}'^2}\eta_{\mu_5\mu_6}C^{\varphi D}$$



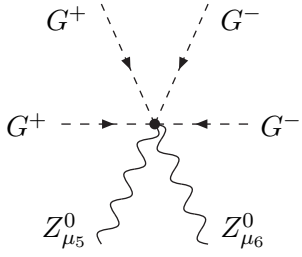
$$-\frac{3}{2}i\bar{g}\sqrt{\bar{g}^2 + \bar{g}'^2}\eta_{\mu_5\mu_6}C^{\varphi D}$$



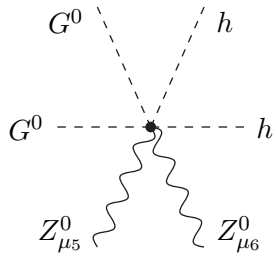
$$+3i\left(\bar{g}^2 + \bar{g}'^2\right)\eta_{\mu_5\mu_6}C^{\varphi D}$$



$$+i\left(\bar{g}'^2 - \bar{g}^2\right)\eta_{\mu_5\mu_6}C^{\varphi D}$$

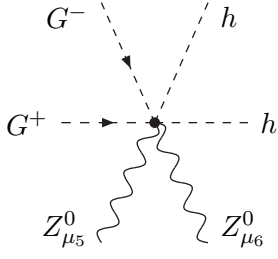


$$+\frac{2i\left(\bar{g}'^2 - \bar{g}^2\right)^2}{\bar{g}^2 + \bar{g}'^2}\eta_{\mu_5\mu_6}C^{\varphi D}$$

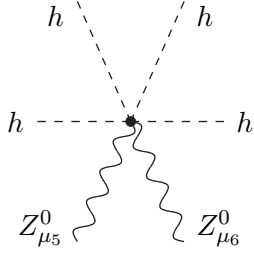


$$+i\left(\bar{g}^2 + \bar{g}'^2\right)\eta_{\mu_5\mu_6}C^{\varphi D}$$

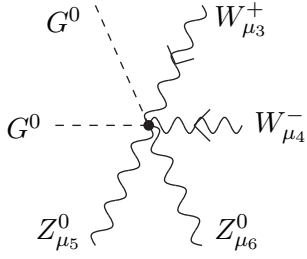




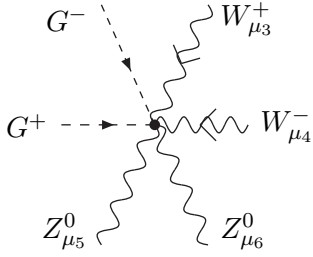
$$+i \left( \bar{g}'^2 - \bar{g}^2 \right) \eta_{\mu_5 \mu_6} C^{\varphi D}$$



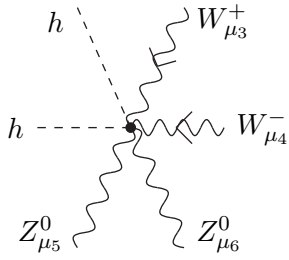
$$+3i \left( \bar{g}^2 + \bar{g}'^2 \right) \eta_{\mu_5 \mu_6} C^{\varphi D}$$



$$-\frac{4i\bar{g}^4}{\bar{g}^2 + \bar{g}'^2} (\eta_{\mu_3 \mu_6} \eta_{\mu_4 \mu_5} + \eta_{\mu_3 \mu_5} \eta_{\mu_4 \mu_6} - 2\eta_{\mu_3 \mu_4} \eta_{\mu_5 \mu_6}) C^{\varphi W}$$

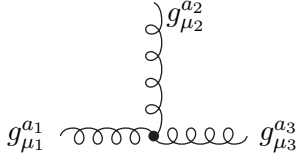


$$-\frac{4i\bar{g}^4}{\bar{g}^2 + \bar{g}'^2} (\eta_{\mu_3 \mu_6} \eta_{\mu_4 \mu_5} + \eta_{\mu_3 \mu_5} \eta_{\mu_4 \mu_6} - 2\eta_{\mu_3 \mu_4} \eta_{\mu_5 \mu_6}) C^{\varphi W}$$

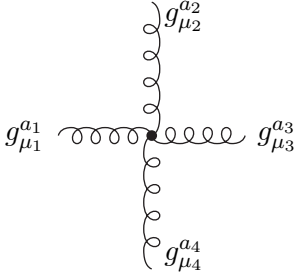


$$-\frac{4i\bar{g}^4}{\bar{g}^2 + \bar{g}'^2} (\eta_{\mu_3 \mu_6} \eta_{\mu_4 \mu_5} + \eta_{\mu_3 \mu_5} \eta_{\mu_4 \mu_6} - 2\eta_{\mu_3 \mu_4} \eta_{\mu_5 \mu_6}) C^{\varphi W}$$

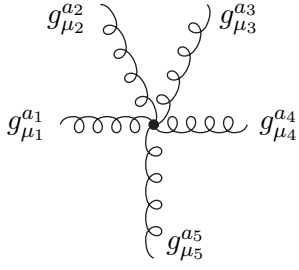
## A.8 Gluon self interaction vertices



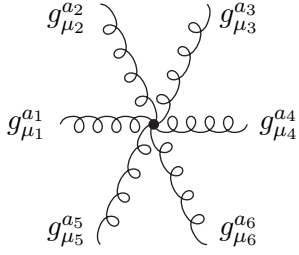
$$\begin{aligned}
& -\bar{g}_s f_{a_1 a_2 a_3} (\eta_{\mu_1 \mu_2} p_1^{\mu_3} - \eta_{\mu_1 \mu_2} p_2^{\mu_3} - \eta_{\mu_1 \mu_3} p_1^{\mu_2} + \eta_{\mu_1 \mu_3} p_3^{\mu_2} \\
& + \eta_{\mu_2 \mu_3} p_2^{\mu_1} - \eta_{\mu_2 \mu_3} p_3^{\mu_1}) + 6f_{a_1 a_2 a_3} C^G (p_1 \cdot p_2 \eta_{\mu_1 \mu_3} p_3^{\mu_2} \\
& - p_1 \cdot p_2 \eta_{\mu_2 \mu_3} p_3^{\mu_1} - p_1 \cdot p_3 \eta_{\mu_1 \mu_2} p_2^{\mu_3} + p_1 \cdot p_3 \eta_{\mu_2 \mu_3} p_2^{\mu_1} \\
& + p_1^{\mu_3} (p_2 \cdot p_3 \eta_{\mu_1 \mu_2} - p_2^{\mu_1} p_3^{\mu_2}) + p_1^{\mu_2} (p_2^{\mu_3} p_3^{\mu_1} - p_2 \cdot p_3 \eta_{\mu_1 \mu_3})) \\
& + 2f_{a_1 a_2 a_3} C^{\tilde{G}} \left( p_1 \cdot p_2 p_3^{\alpha_1} \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1} + p_1 \cdot p_3 p_2^{\alpha_1} \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1} \right. \\
& + p_2 \cdot p_3 p_1^{\alpha_1} \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1} + \eta_{\mu_1 \mu_2} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_3 \alpha_1 \beta_1 \gamma_1} \\
& + \eta_{\mu_1 \mu_3} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_2 \alpha_1 \beta_1 \gamma_1} + \eta_{\mu_2 \mu_3} p_1^{\alpha_1} p_2^{\beta_1} p_3^{\gamma_1} \epsilon_{\mu_1 \alpha_1 \beta_1 \gamma_1} \\
& + p_1^{\alpha_1} p_3^{\beta_1} p_2^{\mu_1} (-\epsilon_{\mu_2 \mu_3 \alpha_1 \beta_1}) + p_3^{\beta_1} (p_2^{\alpha_1} p_1^{\mu_3} + p_1^{\alpha_1} p_2^{\mu_3}) \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1} \\
& - p_1^{\alpha_1} p_2^{\beta_1} p_3^{\mu_1} \epsilon_{\mu_2 \mu_3 \alpha_1 \beta_1} + \epsilon_{\mu_1 \mu_3 \alpha_1 \beta_1} \left( p_2^{\alpha_1} p_3^{\beta_1} p_1^{\mu_2} - p_1^{\alpha_1} p_2^{\beta_1} p_3^{\mu_2} \right) \Big) \\
& + 2v^2 \bar{g}_s f_{a_1 a_2 a_3} C^{\varphi \tilde{G}} (p_1^{\alpha_1} + p_2^{\alpha_1} + p_3^{\alpha_1}) \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1}
\end{aligned}$$



$$\begin{aligned}
& + i\bar{g}_s^2 ((\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}) f_{a_1a_2b_1} f_{a_3a_4b_1} \\
& + (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_3b_1} f_{a_2a_4b_1} \\
& + (\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_4b_1} f_{a_2a_3b_1}) \\
& - 6i\bar{g}_s C^G (f_{a_1a_4b_1} f_{a_2a_3b_1} (-p_2^{\mu_4} p_3^{\mu_2} \eta_{\mu_1\mu_3} + \eta_{\mu_2\mu_4} p_1 \cdot p_4 \eta_{\mu_1\mu_3} \\
& + \eta_{\mu_2\mu_4} p_2 \cdot p_3 \eta_{\mu_1\mu_3} + p_1^{\mu_4} (p_4^{\mu_3} \eta_{\mu_1\mu_2} - p_4^{\mu_2} \eta_{\mu_1\mu_3}) + p_1^{\mu_3} p_4^{\mu_2} \eta_{\mu_1\mu_4} - p_1^{\mu_2} p_4^{\mu_3} \eta_{\mu_1\mu_4} \\
& + p_2^{\mu_4} p_3^{\mu_1} \eta_{\mu_2\mu_3} - p_2^{\mu_1} p_3^{\mu_4} \eta_{\mu_2\mu_3} - p_1^{\mu_3} p_4^{\mu_1} \eta_{\mu_2\mu_4} + p_2^{\mu_3} (p_3^{\mu_4} \eta_{\mu_1\mu_2} - p_3^{\mu_1} \eta_{\mu_2\mu_4}) \\
& + p_2^{\mu_1} p_3^{\mu_2} \eta_{\mu_3\mu_4} + p_1^{\mu_2} p_4^{\mu_1} \eta_{\mu_3\mu_4} - \eta_{\mu_1\mu_2} \eta_{\mu_3\mu_4} p_1 \cdot p_4 - \eta_{\mu_1\mu_2} \eta_{\mu_3\mu_4} p_2 \cdot p_3) \\
& + f_{a_1a_3b_1} f_{a_2a_4b_1} (p_1^{\mu_4} p_3^{\mu_2} \eta_{\mu_1\mu_3} - p_1^{\mu_2} p_3^{\mu_4} \eta_{\mu_1\mu_3} - p_2^{\mu_3} p_4^{\mu_2} \eta_{\mu_1\mu_4} \\
& + p_1^{\mu_3} (p_3^{\mu_4} \eta_{\mu_1\mu_2} - p_3^{\mu_2} \eta_{\mu_1\mu_4}) - p_1^{\mu_4} p_3^{\mu_1} \eta_{\mu_2\mu_3} + p_2^{\mu_4} (p_4^{\mu_3} \eta_{\mu_1\mu_2} - p_4^{\mu_2} \eta_{\mu_2\mu_3}) \\
& + p_2^{\mu_3} p_4^{\mu_1} \eta_{\mu_2\mu_4} - p_2^{\mu_1} p_4^{\mu_3} \eta_{\mu_2\mu_4} + p_1^{\mu_2} p_3^{\mu_1} \eta_{\mu_3\mu_4} + p_2^{\mu_1} p_4^{\mu_2} \eta_{\mu_3\mu_4} + \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} p_1 \cdot p_3 \\
& - \eta_{\mu_1\mu_2} \eta_{\mu_3\mu_4} p_1 \cdot p_3 + \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} p_2 \cdot p_4 - \eta_{\mu_1\mu_2} \eta_{\mu_3\mu_4} p_2 \cdot p_4) \\
& + f_{a_1a_2b_1} f_{a_3a_4b_1} (p_1^{\mu_2} p_2^{\mu_4} \eta_{\mu_1\mu_3} + p_3^{\mu_4} p_4^{\mu_2} \eta_{\mu_1\mu_3} - \eta_{\mu_2\mu_4} p_1 \cdot p_2 \eta_{\mu_1\mu_3} \\
& - \eta_{\mu_2\mu_4} p_3 \cdot p_4 \eta_{\mu_1\mu_3} - p_1^{\mu_2} p_2^{\mu_3} \eta_{\mu_1\mu_4} - p_3^{\mu_2} p_4^{\mu_3} \eta_{\mu_1\mu_4} - p_3^{\mu_4} p_4^{\mu_1} \eta_{\mu_2\mu_3} \\
& + p_1^{\mu_4} (p_2^{\mu_3} \eta_{\mu_1\mu_2} - p_2^{\mu_2} \eta_{\mu_2\mu_3}) + p_3^{\mu_4} p_4^{\mu_3} \eta_{\mu_2\mu_4} + p_1^{\mu_3} (p_2^{\mu_4} \eta_{\mu_2\mu_4} - p_2^{\mu_2} \eta_{\mu_1\mu_2}) \\
& + p_3^{\mu_2} p_4^{\mu_1} \eta_{\mu_3\mu_4} - p_3^{\mu_1} p_4^{\mu_2} \eta_{\mu_3\mu_4} + \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} p_1 \cdot p_2 + \eta_{\mu_1\mu_4} \eta_{\mu_2\mu_3} p_3 \cdot p_4)) \\
& - 2i\bar{g}_s C^{\tilde{G}} \left( -\epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\mu_4} p_2^{\alpha_1} + \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\mu_1} p_2^{\alpha_1} \right. \\
& - \epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\mu_4} p_2^{\alpha_1} - \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_4^{\mu_1} p_2^{\alpha_1} \\
& - \epsilon_{\mu_3\mu_4\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\beta_1} \eta_{\mu_1\mu_2} p_2^{\alpha_1} + \epsilon_{\mu_3\mu_4\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_4^{\beta_1} \eta_{\mu_1\mu_2} p_2^{\alpha_1} \\
& - \epsilon_{\mu_2\mu_4\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\beta_1} \eta_{\mu_1\mu_3} p_2^{\alpha_1} - \epsilon_{\mu_2\mu_3\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_4^{\beta_1} \eta_{\mu_1\mu_4} p_2^{\alpha_1} - \epsilon_{\mu_1\mu_4\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\beta_1} \eta_{\mu_1\mu_2} p_2^{\alpha_1} \\
& - \epsilon_{\mu_1\mu_4\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_4^{\beta_1} \eta_{\mu_2\mu_3} p_2^{\alpha_1} - \epsilon_{\mu_1\mu_3\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\beta_1} \eta_{\mu_2\mu_4} p_2^{\alpha_1} - \epsilon_{\mu_1\mu_3\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_4^{\beta_1} \eta_{\mu_2\mu_3} p_2^{\alpha_1} \\
& - \epsilon_{\mu_1\mu_2\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\beta_1} \eta_{\mu_3\mu_4} p_2^{\alpha_1} - \epsilon_{\mu_1\mu_2\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_4^{\beta_1} \eta_{\mu_3\mu_4} p_2^{\alpha_1} - \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\beta_1} p_2^{\alpha_1} \\
& - \epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\mu_4} + \epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_1^{\mu_4} p_3^{\alpha_1} + \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\beta_1} p_2^{\alpha_1} \\
& - \epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_2^{\mu_4} p_3^{\alpha_1} + \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_1^{\alpha_1} p_3^{\mu_1} + \epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_3^{\beta_1} p_2^{\alpha_1} \\
& + \epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\mu_4} p_4^{\alpha_1} - \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_2^{\mu_1} p_4^{\alpha_1} - \epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_3^{\beta_1} p_2^{\alpha_1} \\
& + \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_3^{\mu_1} p_4^{\alpha_1} + \epsilon_{\mu_1\mu_2\mu_3\alpha_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_3^{\mu_4} p_4^{\alpha_1} - \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_3^{\beta_1} p_2^{\alpha_1} \\
& + \epsilon_{\mu_2\mu_3\mu_4\alpha_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_3^{\alpha_1} p_4^{\mu_1} + \epsilon_{\mu_1\mu_3\mu_4\alpha_1} (f_{a_1a_4b_1} f_{a_2a_3b_1} (p_2^{\alpha_1} p_3^{\mu_2} - p_1^{\mu_2} p_4^{\alpha_1} - p_1^{\alpha_1} p_4^{\mu_2})) \\
& + f_{a_1a_3b_1} f_{a_2a_4b_1} (p_1^{\mu_2} p_3^{\alpha_1} + p_1^{\alpha_1} p_3^{\mu_2} - p_2^{\alpha_1} p_4^{\mu_2}) + f_{a_1a_2b_1} f_{a_3a_4b_1} (p_1^{\mu_2} p_2^{\alpha_1} - p_3^{\mu_2} p_4^{\alpha_1} - p_3^{\alpha_1} p_4^{\mu_2})) \\
& + \epsilon_{\mu_1\mu_2\mu_4\alpha_1} (f_{a_1a_4b_1} f_{a_2a_3b_1} (-p_2^{\mu_3} p_3^{\alpha_1} + p_1^{\mu_3} p_4^{\alpha_1} + p_1^{\alpha_1} p_4^{\mu_3}) + f_{a_1a_3b_1} f_{a_2a_4b_1} (p_1^{\mu_3} p_3^{\alpha_1} - p_2^{\mu_3} p_4^{\alpha_1} \\
& + f_{a_1a_2b_1} f_{a_3a_4b_1} (p_1^{\mu_3} p_2^{\alpha_1} + p_1^{\alpha_1} p_2^{\mu_3} - p_3^{\alpha_1} p_4^{\mu_3})) - \epsilon_{\mu_3\mu_4\alpha_1\beta_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_1\mu_2} \\
& - \epsilon_{\mu_3\mu_4\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_2} + \epsilon_{\mu_3\mu_4\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_2} - \epsilon_{\mu_2\mu_4\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_3} \\
& - \epsilon_{\mu_2\mu_4\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_3} - \epsilon_{\mu_2\mu_4\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_3} + \epsilon_{\mu_2\mu_4\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_1\mu_4} \\
& - \epsilon_{\mu_2\mu_3\alpha_1\beta_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_1\mu_4} - \epsilon_{\mu_2\mu_3\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_1\mu_4} - \epsilon_{\mu_2\mu_3\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\alpha_1} p_4^{\beta_1} \eta_{\mu_2\mu_3} \\
& + \epsilon_{\mu_2\mu_3\alpha_1\beta_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_1\mu_4} - \epsilon_{\mu_1\mu_4\alpha_1\beta_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_2\mu_3} - \epsilon_{\mu_1\mu_4\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_2\mu_3} \\
& - \epsilon_{\mu_1\mu_4\alpha_1\beta_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_2\mu_3} + \epsilon_{\mu_1\mu_3\alpha_1\beta_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_2\mu_4} - \epsilon_{\mu_1\mu_3\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_2\mu_4} \\
& - \epsilon_{\mu_1\mu_3\alpha_1\beta_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_2\mu_4} + \epsilon_{\mu_1\mu_2\alpha_1\beta_1} f_{a_1a_3b_1} f_{a_2a_4b_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_3\mu_4} + \epsilon_{\mu_1\mu_2\alpha_1\beta_1} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1^{\alpha_1} p_3^{\beta_1} \eta_{\mu_3\mu_4} \\
& - \epsilon_{\mu_1\mu_2\alpha_1\beta_1} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1^{\alpha_1} p_2^{\beta_1} \eta_{\mu_3\mu_4} - \epsilon_{\mu_1\mu_2\mu_3\mu_4} f_{a_1a_2b_1} f_{a_3a_4b_1} p_1 \cdot p_2 + \epsilon_{\mu_1\mu_2\mu_3\mu_4} f_{a_1a_3b_1} f_{a_2a_4b_1} p_1 \cdot p_2 \\
& - \epsilon_{\mu_1\mu_2\mu_3\mu_4} f_{a_1a_4b_1} f_{a_2a_3b_1} p_1 \cdot p_4 - \epsilon_{\mu_1\mu_2\mu_3\mu_4} f_{a_1a_4b_1} f_{a_2a_3b_1} p_2 \cdot p_3 + \epsilon_{\mu_1\mu_2\mu_3\mu_4} f_{a_1a_3b_1} f_{a_2a_4b_1} p_2 \cdot p_3 \\
& - \epsilon_{\mu_1\mu_2\mu_3\mu_4} f_{a_1a_2b_1} f_{a_3a_4b_1} p_3 \cdot p_4) \\
& + 2iv^2 \bar{g}_s^2 \epsilon_{\mu_1\mu_2\mu_3\mu_4} C^{\varphi\tilde{G}} (f_{a_1a_4b_1} f_{a_2a_3b_1} - f_{a_1a_3b_1} f_{a_2a_4b_1} + f_{a_1a_2b_1} f_{a_3a_4b_1})
\end{aligned}$$

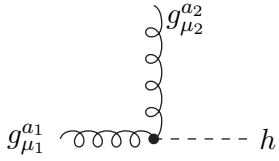


*+LongExpressionNotDisplayed*

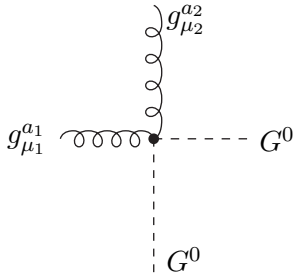


*+LongExpressionNotDisplayed*

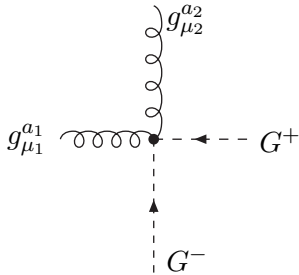
## A.9 Higgs-gluon vertices



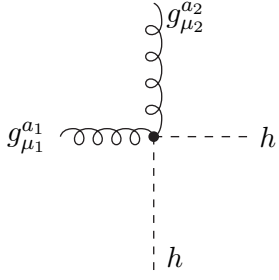
$$+4iv\delta_{a_1 a_2} C^{\varphi G} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) + 4iv\delta_{a_1 a_2} C^{\varphi \tilde{G}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1}$$



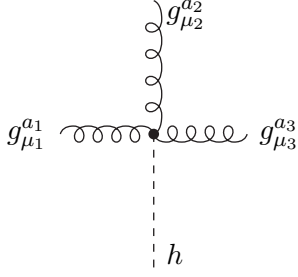
$$+4i\delta_{a_1 a_2} C^{\varphi G} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) + 4i\delta_{a_1 a_2} C^{\varphi \tilde{G}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1}$$



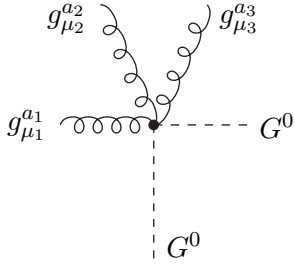
$$+4i\delta_{a_1 a_2} C^{\varphi G} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) + 4i\delta_{a_1 a_2} C^{\varphi \tilde{G}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1}$$



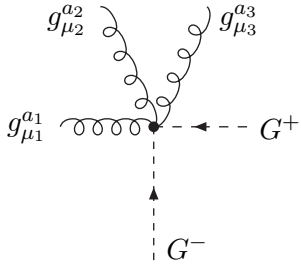
$$+4i\delta_{a_1 a_2} C^{\varphi G} (p_1^{\mu_2} p_2^{\mu_1} - p_1 \cdot p_2 \eta_{\mu_1 \mu_2}) + 4i\delta_{a_1 a_2} C^{\varphi \tilde{G}} p_1^{\alpha_1} p_2^{\beta_1} \epsilon_{\mu_1 \mu_2 \alpha_1 \beta_1}$$



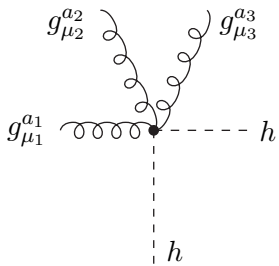
$$+4v\bar{g}_s f_{a_1 a_2 a_3} C^{\varphi G} (\eta_{\mu_1 \mu_2} p_1^{\mu_3} - \eta_{\mu_1 \mu_2} p_2^{\mu_3} - \eta_{\mu_1 \mu_3} p_1^{\mu_2} + \eta_{\mu_1 \mu_3} p_3^{\mu_2} \\ + \eta_{\mu_2 \mu_3} p_2^{\mu_1} - \eta_{\mu_2 \mu_3} p_3^{\mu_1}) + 4v\bar{g}_s f_{a_1 a_2 a_3} C^{\varphi \tilde{G}} (p_1^{\alpha_1} + p_2^{\alpha_1} + p_3^{\alpha_1}) \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1}$$



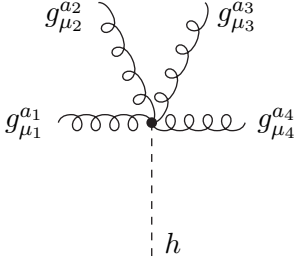
$$+4\bar{g}_s f_{a_1 a_2 a_3} C^{\varphi G} (\eta_{\mu_1 \mu_2} p_1^{\mu_3} - \eta_{\mu_1 \mu_2} p_2^{\mu_3} - \eta_{\mu_1 \mu_3} p_1^{\mu_2} + \eta_{\mu_1 \mu_3} p_3^{\mu_2} \\ + \eta_{\mu_2 \mu_3} p_2^{\mu_1} - \eta_{\mu_2 \mu_3} p_3^{\mu_1}) + 4\bar{g}_s f_{a_1 a_2 a_3} C^{\varphi \tilde{G}} (p_1^{\alpha_1} + p_2^{\alpha_1} + p_3^{\alpha_1}) \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1}$$



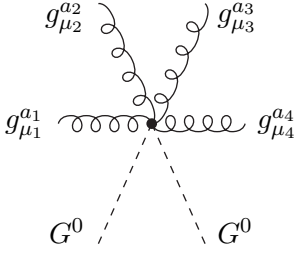
$$+4\bar{g}_s f_{a_1 a_2 a_3} C^{\varphi G} (\eta_{\mu_1 \mu_2} p_1^{\mu_3} - \eta_{\mu_1 \mu_2} p_2^{\mu_3} - \eta_{\mu_1 \mu_3} p_1^{\mu_2} + \eta_{\mu_1 \mu_3} p_3^{\mu_2} \\ + \eta_{\mu_2 \mu_3} p_2^{\mu_1} - \eta_{\mu_2 \mu_3} p_3^{\mu_1}) + 4\bar{g}_s f_{a_1 a_2 a_3} C^{\varphi \tilde{G}} (p_1^{\alpha_1} + p_2^{\alpha_1} + p_3^{\alpha_1}) \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1}$$



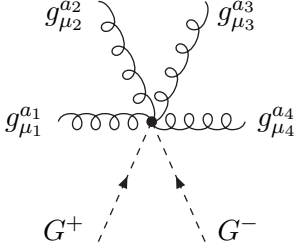
$$+4\bar{g}_s f_{a_1 a_2 a_3} C^{\varphi G} (\eta_{\mu_1 \mu_2} p_1^{\mu_3} - \eta_{\mu_1 \mu_2} p_2^{\mu_3} - \eta_{\mu_1 \mu_3} p_1^{\mu_2} + \eta_{\mu_1 \mu_3} p_3^{\mu_2} \\ + \eta_{\mu_2 \mu_3} p_2^{\mu_1} - \eta_{\mu_2 \mu_3} p_3^{\mu_1}) + 4\bar{g}_s f_{a_1 a_2 a_3} C^{\varphi \tilde{G}} (p_1^{\alpha_1} + p_2^{\alpha_1} + p_3^{\alpha_1}) \epsilon_{\mu_1 \mu_2 \mu_3 \alpha_1}$$



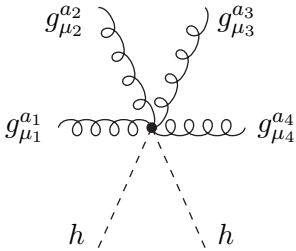
$$\begin{aligned}
& -4iv\bar{g}_s^2 C^{\varphi G} ((\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}) f_{a_1a_2b_1} f_{a_3a_4b_1} \\
& + (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_3b_1} f_{a_2a_4b_1} \\
& + (\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_4b_1} f_{a_2a_3b_1}) \\
& + 4iv\bar{g}_s^2 \epsilon_{\mu_1\mu_2\mu_3\mu_4} C^{\varphi\tilde{G}} (f_{a_1a_4b_1} f_{a_2a_3b_1} - f_{a_1a_3b_1} f_{a_2a_4b_1} + f_{a_1a_2b_1} f_{a_3a_4b_1})
\end{aligned}$$



$$\begin{aligned}
& -4i\bar{g}_s^2 C^{\varphi G} ((\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}) f_{a_1a_2b_1} f_{a_3a_4b_1} \\
& + (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_3b_1} f_{a_2a_4b_1} \\
& + (\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_4b_1} f_{a_2a_3b_1}) \\
& + 4i\bar{g}_s^2 \epsilon_{\mu_1\mu_2\mu_3\mu_4} C^{\varphi\tilde{G}} (f_{a_1a_4b_1} f_{a_2a_3b_1} - f_{a_1a_3b_1} f_{a_2a_4b_1} + f_{a_1a_2b_1} f_{a_3a_4b_1})
\end{aligned}$$

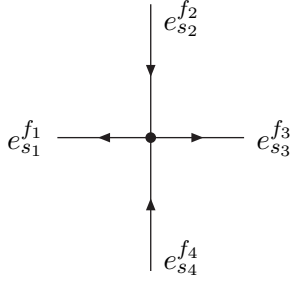


$$\begin{aligned}
& -4i\bar{g}_s^2 C^{\varphi G} ((\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}) f_{a_1a_2b_1} f_{a_3a_4b_1} \\
& + (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_3b_1} f_{a_2a_4b_1} \\
& + (\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_4b_1} f_{a_2a_3b_1}) \\
& + 4i\bar{g}_s^2 \epsilon_{\mu_1\mu_2\mu_3\mu_4} C^{\varphi\tilde{G}} (f_{a_1a_4b_1} f_{a_2a_3b_1} - f_{a_1a_3b_1} f_{a_2a_4b_1} + f_{a_1a_2b_1} f_{a_3a_4b_1})
\end{aligned}$$

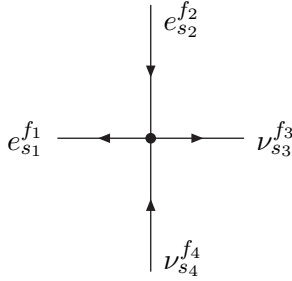


$$\begin{aligned}
& -4i\bar{g}_s^2 C^{\varphi G} ((\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4}) f_{a_1a_2b_1} f_{a_3a_4b_1} \\
& + (\eta_{\mu_1\mu_4}\eta_{\mu_2\mu_3} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_3b_1} f_{a_2a_4b_1} \\
& + (\eta_{\mu_1\mu_3}\eta_{\mu_2\mu_4} - \eta_{\mu_1\mu_2}\eta_{\mu_3\mu_4}) f_{a_1a_4b_1} f_{a_2a_3b_1}) \\
& + 4i\bar{g}_s^2 \epsilon_{\mu_1\mu_2\mu_3\mu_4} C^{\varphi\tilde{G}} (f_{a_1a_4b_1} f_{a_2a_3b_1} - f_{a_1a_3b_1} f_{a_2a_4b_1} + f_{a_1a_2b_1} f_{a_3a_4b_1})
\end{aligned}$$

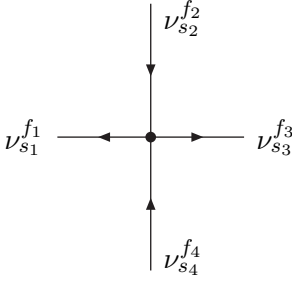
## A.10 Four lepton vertices



$$\begin{aligned}
& -2i \left( C_{f_1 f_4 f_3 f_2}^e (\gamma^\mu P_R)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} \right. \\
& \quad \left. - C_{f_1 f_2 f_3 f_4}^e (\gamma^\mu P_R)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \right) \\
& + i \left( C_{f_3 f_4 f_1 f_2}^{le} (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} - C_{f_3 f_2 f_1 f_4}^{le} (\gamma^\mu P_L)_{s_3 s_2} (\gamma_\mu P_R)_{s_1 s_4} \right. \\
& \quad \left. - C_{f_1 f_4 f_3 f_2}^{le} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} + C_{f_1 f_2 f_3 f_4}^{le} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \right) \\
& - 2i \left( C_{f_1 f_4 f_3 f_2}^{ll} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_L)_{s_3 s_2} \right. \\
& \quad \left. - C_{f_1 f_2 f_3 f_4}^{ll} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} \right)
\end{aligned}$$

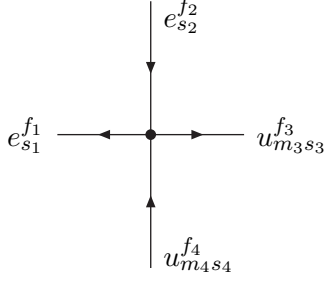


$$\begin{aligned}
& + i (\gamma^\mu P_R)_{s_1 s_2} C_{g_1 g_2 f_1 f_2}^{le} (U_{g_2 f_4} U_{g_1 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} - U_{g_2 f_3} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_3 s_4}) \\
& + 2i (\gamma^\mu P_L)_{s_1 s_2} C_{f_1 f_2 g_1 g_2}^{ll} (U_{g_2 f_4} U_{g_1 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} - U_{g_2 f_3} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_3 s_4})
\end{aligned}$$

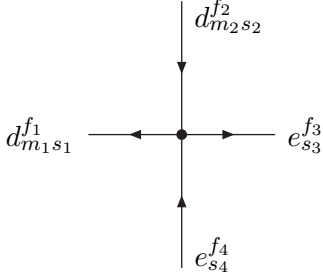


$$\begin{aligned}
& -2i \left( C_{g_1 g_3 g_2 g_4}^{ll} (U_{g_3 f_3} U_{g_1 f_1}^* (\gamma^\mu P_L)_{s_1 s_3} \right. \\
& \quad - U_{g_3 f_1} U_{g_1 f_3}^* (\gamma^\mu P_R)_{s_1 s_3}) (U_{g_4 f_4} U_{g_2 f_2}^* (\gamma^\mu P_L)_{s_2 s_4} \\
& \quad - U_{g_4 f_2} U_{g_2 f_4}^* (\gamma^\mu P_R)_{s_2 s_4}) + C_{g_1 g_4 g_3 g_2}^{ll} (U_{g_4 f_4} U_{g_1 f_1}^* (\gamma^\mu P_L)_{s_1 s_4} \\
& \quad - U_{g_4 f_1} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_1 s_4}) (U_{g_2 f_2} U_{g_3 f_3}^* (\gamma^\mu P_L)_{s_3 s_2} \\
& \quad - U_{g_2 f_3} U_{g_3 f_2}^* (\gamma^\mu P_R)_{s_3 s_2}) - C_{g_1 g_2 g_3 g_4}^{ll} (U_{g_2 f_2} U_{g_1 f_1}^* (\gamma^\mu P_L)_{s_1 s_2} \\
& \quad - U_{g_2 f_1} U_{g_1 f_2}^* (\gamma^\mu P_R)_{s_1 s_2}) (U_{g_4 f_4} U_{g_3 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} \\
& \quad \left. - U_{g_4 f_3} U_{g_3 f_4}^* (\gamma^\mu P_R)_{s_3 s_4}) \right)
\end{aligned}$$

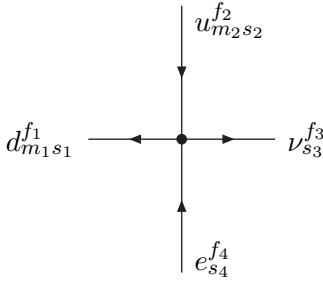
## A.11 Two quark–two lepton vertices



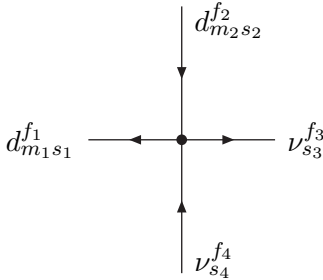
$$\begin{aligned}
& + i C_{f_1 f_2 f_3 f_4}^{eu} (\gamma^\mu P_R)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \\
& - i \left( (P_L)_{s_1 s_2} (P_L)_{s_3 s_4} K_{f_4 g_1}^* C_{f_2 f_1 g_1 f_3}^{lequ1*} \right. \\
& \left. + (P_R)_{s_1 s_2} (P_R)_{s_3 s_4} K_{f_3 g_1} C_{f_1 f_2 g_1 f_4}^{lequ1} \right) \\
& - i \left( K_{f_4 g_1}^* (\sigma^{\mu\nu} P_L)_{s_1 s_2} (\sigma_{\mu\nu} P_L)_{s_3 s_4} C_{f_2 f_1 g_1 f_3}^{lequ3*} \right. \\
& \left. + K_{f_3 g_1} C_{f_1 f_2 g_1 f_4}^{lequ3} (\sigma^{\mu\nu} P_R)_{s_1 s_2} (\sigma_{\mu\nu} P_R)_{s_3 s_4} \right) \\
& + i K_{f_3 g_1} K_{f_4 g_2}^* (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} C_{f_1 f_2 g_1 g_2}^{lq1} \\
& - i K_{f_3 g_1} K_{f_4 g_2}^* (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} C_{f_1 f_2 g_1 g_2}^{lq3} \\
& + i C_{f_1 f_2 f_3 f_4}^{lu} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \\
& + i K_{f_3 g_2} K_{f_4 g_1}^* (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} C_{g_2 g_1 f_1 f_2}^{qe}
\end{aligned}$$



$$\begin{aligned}
& + i C_{f_3 f_4 f_1 f_2}^{ed} (\gamma^\mu P_R)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} + i C_{f_3 f_4 f_1 f_2}^{ld} (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} \\
& + i \left( (P_L)_{s_3 s_4} (P_R)_{s_1 s_2} C_{f_4 f_3 f_2 f_1}^{ledq*} + (P_L)_{s_1 s_2} (P_R)_{s_3 s_4} C_{f_3 f_4 f_1 f_2}^{ledq} \right) \\
& + i C_{f_3 f_4 f_1 f_2}^{lq1} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} + i C_{f_3 f_4 f_1 f_2}^{lq3} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} \\
& + i C_{f_1 f_2 f_3 f_4}^{qe} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4}
\end{aligned}$$

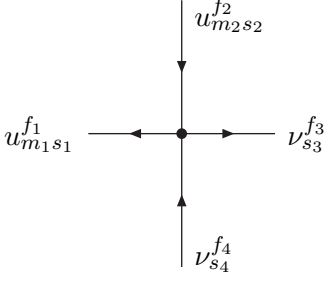


$$\begin{aligned}
& + i (P_L)_{s_1 s_2} (P_R)_{s_3 s_4} U_{g_1 f_3}^* K_{f_2 g_2}^* C_{g_1 f_4 f_1 g_2}^{ledq} \\
& + i (P_R)_{s_1 s_2} (P_R)_{s_3 s_4} U_{g_1 f_3}^* C_{g_1 f_4 f_1 f_2}^{lequ1} \\
& + i U_{g_1 f_3}^* C_{g_1 f_4 f_1 f_2}^{lequ3} (\sigma^{\mu\nu} P_R)_{s_1 s_2} (\sigma_{\mu\nu} P_R)_{s_3 s_4} \\
& + 2 i U_{g_1 f_3}^* K_{f_2 g_2}^* (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} C_{g_1 f_4 f_1 g_2}^{lq3}
\end{aligned}$$



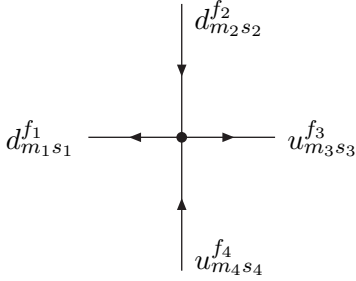
$$\begin{aligned}
& + i (\gamma^\mu P_R)_{s_1 s_2} C_{g_1 g_2 f_1 f_2}^{ld} (U_{g_2 f_4} U_{g_1 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} - U_{g_2 f_3} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_3 s_4}) \\
& + i (\gamma^\mu P_L)_{s_1 s_2} C_{g_1 g_2 f_1 f_2}^{lq1} (U_{g_2 f_4} U_{g_1 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} - U_{g_2 f_3} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_3 s_4}) \\
& - i (\gamma^\mu P_L)_{s_1 s_2} C_{g_1 g_2 f_1 f_2}^{lq3} (U_{g_2 f_4} U_{g_1 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} - U_{g_2 f_3} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_3 s_4})
\end{aligned}$$



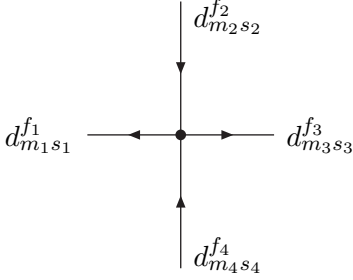


$$\begin{aligned}
& + i K_{f_1 g_3} K_{f_2 g_4}^* (\gamma^\mu P_L)_{s_1 s_2} C_{g_1 g_2 g_3 g_4}^{lq1} (U_{g_2 f_4} U_{g_1 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} \\
& - U_{g_2 f_3} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_3 s_4}) \\
& + i K_{f_1 g_3} K_{f_2 g_4}^* (\gamma^\mu P_L)_{s_1 s_2} C_{g_1 g_2 g_3 g_4}^{lq3} (U_{g_2 f_4} U_{g_1 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} \\
& - U_{g_2 f_3} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_3 s_4}) \\
& + i (\gamma^\mu P_R)_{s_1 s_2} C_{g_1 g_2 f_1 f_2}^{lu} (U_{g_2 f_4} U_{g_1 f_3}^* (\gamma^\mu P_L)_{s_3 s_4} \\
& - U_{g_2 f_3} U_{g_1 f_4}^* (\gamma^\mu P_R)_{s_3 s_4})
\end{aligned}$$

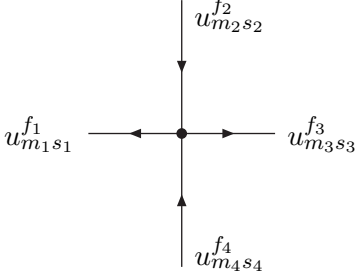
## A.12 Four quark vertices



$$\begin{aligned}
& + i \delta_{m_1 m_2} \delta_{m_3 m_4} K_{f_3 g_2} K_{f_4 g_1}^* (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} C_{g_2 g_1 f_1 f_2}^{qd1} \\
& + \frac{i}{6} (3 \delta_{m_1 m_4} \delta_{m_2 m_3} - \delta_{m_1 m_2} \delta_{m_3 m_4}) K_{f_3 g_2} K_{f_4 g_1}^* (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} C_{g_2 g_1 f_1 f_2}^{qd8} \\
& + 2 i \delta_{m_1 m_2} \delta_{m_3 m_4} K_{f_3 g_2} K_{f_4 g_1}^* (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} C_{f_1 f_2 g_2 g_1}^{qq1} \\
& - 2 i K_{f_3 g_2} K_{f_4 g_1}^* \left( 2 \delta_{m_1 m_4} \delta_{m_2 m_3} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_L)_{s_3 s_2} C_{f_1 g_1 g_2 f_2}^{qq3} \right. \\
& + \delta_{m_1 m_2} \delta_{m_3 m_4} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} C_{f_1 f_2 g_2 g_1}^{qq3} \left. \right) \\
& + i \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_1 f_2 f_3 f_4}^{qu1} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \\
& + \frac{i}{6} (3 \delta_{m_1 m_4} \delta_{m_2 m_3} - \delta_{m_1 m_2} \delta_{m_3 m_4}) C_{f_1 f_2 f_3 f_4}^{qu8} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \\
& + i \left( \delta_{m_1 m_4} \delta_{m_2 m_3} (P_L)_{s_1 s_4} (P_L)_{s_3 s_2} K_{f_4 g_1}^* C_{f_2 f_3 g_1 f_1}^{quqd1*} \right. \\
& + \delta_{m_1 m_2} \delta_{m_3 m_4} (P_L)_{s_1 s_2} (P_L)_{s_3 s_4} K_{f_4 g_1}^* C_{g_1 f_3 f_2 f_1}^{quqd1*} \\
& + K_{f_3 g_1} \left( \delta_{m_1 m_4} \delta_{m_2 m_3} (P_R)_{s_1 s_4} (P_R)_{s_3 s_2} C_{f_1 f_4 g_1 f_2}^{quqd1} \right. \\
& + \delta_{m_1 m_2} \delta_{m_3 m_4} (P_R)_{s_1 s_2} (P_R)_{s_3 s_4} C_{g_1 f_4 f_1 f_2}^{quqd1} \left. \right) \left. \right) \\
& - \frac{i}{6} \left( (\delta_{m_1 m_4} \delta_{m_2 m_3} - 3 \delta_{m_1 m_2} \delta_{m_3 m_4}) (P_L)_{s_1 s_4} (P_L)_{s_3 s_2} K_{f_4 g_1}^* C_{f_2 f_3 g_1 f_1}^{quqd8*} \right. \\
& + (\delta_{m_1 m_2} \delta_{m_3 m_4} - 3 \delta_{m_1 m_4} \delta_{m_2 m_3}) (P_L)_{s_1 s_2} (P_L)_{s_3 s_4} K_{f_4 g_1}^* C_{g_1 f_3 f_2 f_1}^{quqd8*} \\
& + K_{f_3 g_1} \left( (\delta_{m_1 m_4} \delta_{m_2 m_3} - 3 \delta_{m_1 m_2} \delta_{m_3 m_4}) (P_R)_{s_1 s_4} (P_R)_{s_3 s_2} C_{f_1 f_4 g_1 f_2}^{quqd8} \right. \\
& + (\delta_{m_1 m_2} \delta_{m_3 m_4} - 3 \delta_{m_1 m_4} \delta_{m_2 m_3}) (P_R)_{s_1 s_2} (P_R)_{s_3 s_4} C_{g_1 f_4 f_1 f_2}^{quqd8} \left. \right) \left. \right) \\
& + i \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_3 f_4 f_1 f_2}^{ud1} (\gamma^\mu P_R)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \\
& + \frac{i}{6} (3 \delta_{m_1 m_4} \delta_{m_2 m_3} - \delta_{m_1 m_2} \delta_{m_3 m_4}) C_{f_3 f_4 f_1 f_2}^{ud8} (\gamma^\mu P_R)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4}
\end{aligned}$$

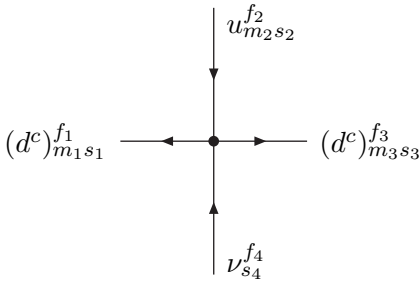


$$\begin{aligned}
& -2i \left( \delta_{m_1 m_4} \delta_{m_2 m_3} C_{f_1 f_4 f_3 f_2}^{dd} (\gamma^\mu P_R)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} \right. \\
& \quad \left. - \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_1 f_2 f_3 f_4}^{dd} (\gamma^\mu P_R)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \right) \\
& + i \left( \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_3 f_4 f_1 f_2}^{qd1} (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} \right. \\
& \quad - \delta_{m_1 m_4} \delta_{m_2 m_3} C_{f_3 f_2 f_1 f_4}^{qd1} (\gamma^\mu P_L)_{s_3 s_2} (\gamma_\mu P_R)_{s_1 s_4} \\
& \quad - \delta_{m_1 m_4} \delta_{m_2 m_3} C_{f_1 f_4 f_3 f_2}^{qd1} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} \\
& \quad \left. + \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_1 f_2 f_3 f_4}^{qd1} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \right) \\
& + \frac{i}{6} \left( (3\delta_{m_1 m_4} \delta_{m_2 m_3} \right. \\
& \quad - \delta_{m_1 m_2} \delta_{m_3 m_4}) C_{f_3 f_4 f_1 f_2}^{qd8} (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} \\
& \quad + (\delta_{m_1 m_4} \delta_{m_2 m_3} \\
& \quad - 3\delta_{m_1 m_2} \delta_{m_3 m_4}) C_{f_3 f_2 f_1 f_4}^{qd8} (\gamma^\mu P_L)_{s_3 s_2} (\gamma_\mu P_R)_{s_1 s_4} \\
& \quad + \delta_{m_1 m_4} \delta_{m_2 m_3} C_{f_1 f_4 f_3 f_2}^{qd8} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} \\
& \quad - 3\delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_1 f_4 f_3 f_2}^{qd8} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} \\
& \quad + 3\delta_{m_1 m_4} \delta_{m_2 m_3} C_{f_1 f_2 f_3 f_4}^{qd8} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \\
& \quad \left. - \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_1 f_2 f_3 f_4}^{qd8} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} \right) \\
& - 2i \left( \delta_{m_1 m_4} \delta_{m_2 m_3} C_{f_1 f_4 f_3 f_2}^{qq1} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_L)_{s_3 s_2} \right. \\
& \quad \left. - \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_1 f_2 f_3 f_4}^{qq1} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} \right) \\
& - 2i \left( \delta_{m_1 m_4} \delta_{m_2 m_3} C_{f_1 f_4 f_3 f_2}^{qq3} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_L)_{s_3 s_2} \right. \\
& \quad \left. - \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_1 f_2 f_3 f_4}^{qq3} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4} \right)
\end{aligned}$$

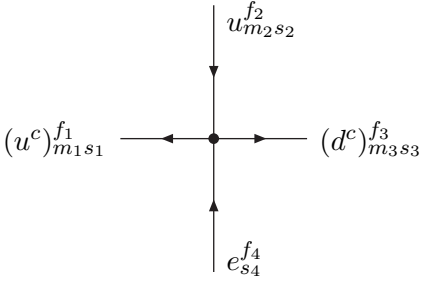
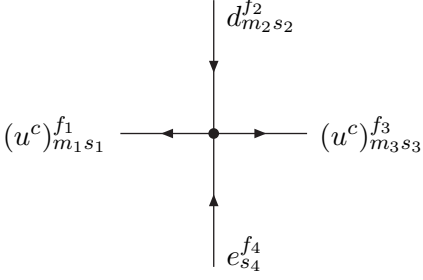
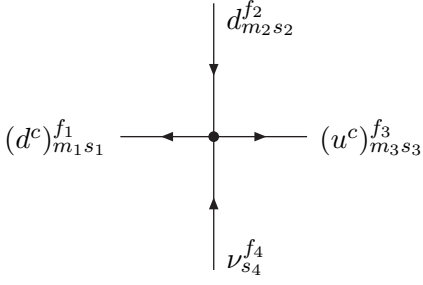


$$\begin{aligned}
& -iK_{f_2 g_1}^* K_{f_4 g_2}^* (C_{g_4 g_1 g_3 g_2}^{qq1} (\delta_{m_1 m_4} \delta_{m_2 m_3} K_{f_1 g_3} K_{f_3 g_4} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_L)_{s_3 s_2} \\
& - \delta_{m_1 m_2} \delta_{m_3 m_4} K_{f_3 g_3} K_{f_1 g_4} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4}) \\
& + C_{g_3 g_1 g_4 g_2}^{qq1} (\delta_{m_1 m_4} \delta_{m_2 m_3} K_{f_3 g_3} K_{f_1 g_4} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_L)_{s_3 s_2} \\
& - \delta_{m_1 m_2} \delta_{m_3 m_4} K_{f_1 g_3} K_{f_3 g_4} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4}) \\
& - iK_{f_2 g_1}^* K_{f_4 g_2}^* (C_{g_4 g_1 g_3 g_2}^{qq3} (\delta_{m_1 m_4} \delta_{m_2 m_3} K_{f_1 g_3} K_{f_3 g_4} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_L)_{s_3 s_2} \\
& - \delta_{m_1 m_2} \delta_{m_3 m_4} K_{f_3 g_3} K_{f_1 g_4} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4}) \\
& + C_{g_3 g_1 g_4 g_2}^{qq3} (\delta_{m_1 m_4} \delta_{m_2 m_3} K_{f_3 g_3} K_{f_1 g_4} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_L)_{s_3 s_2} \\
& - \delta_{m_1 m_2} \delta_{m_3 m_4} K_{f_1 g_3} K_{f_3 g_4} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_L)_{s_3 s_4}) \\
& + i \left( K_{f_4 g_1}^* \left( \delta_{m_1 m_2} \delta_{m_3 m_4} K_{f_3 g_2} (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} C_{g_2 g_1 f_1 f_2}^{qu1} \right. \right. \\
& - \delta_{m_1 m_4} \delta_{m_2 m_3} K_{f_1 g_2} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} C_{g_2 g_1 f_3 f_2}^{qu1} \\
& + K_{f_2 g_1}^* \left( \delta_{m_1 m_2} \delta_{m_3 m_4} K_{f_1 g_2} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} C_{g_2 g_1 f_3 f_4}^{qu1} \right. \\
& - \delta_{m_1 m_4} \delta_{m_2 m_3} K_{f_3 g_2} (\gamma^\mu P_L)_{s_3 s_2} (\gamma_\mu P_R)_{s_1 s_4} C_{g_2 g_1 f_1 f_4}^{qu1} \left. \left. \right) \right) \\
& + \frac{i}{6} \left( K_{f_4 g_1}^* \left( (3\delta_{m_1 m_4} \delta_{m_2 m_3} - \delta_{m_1 m_2} \delta_{m_3 m_4}) K_{f_3 g_2} (\gamma^\mu P_L)_{s_3 s_4} (\gamma_\mu P_R)_{s_1 s_2} C_{g_2 g_1 f_1 f_2}^{qu8} \right. \right. \\
& + (\delta_{m_1 m_4} \delta_{m_2 m_3} - 3\delta_{m_1 m_2} \delta_{m_3 m_4}) K_{f_1 g_2} (\gamma^\mu P_L)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} C_{g_2 g_1 f_3 f_2}^{qu8} \\
& + K_{f_2 g_1}^* \left( (\delta_{m_1 m_4} \delta_{m_2 m_3} - 3\delta_{m_1 m_2} \delta_{m_3 m_4}) K_{f_3 g_2} (\gamma^\mu P_L)_{s_3 s_2} (\gamma_\mu P_R)_{s_1 s_4} C_{g_2 g_1 f_1 f_4}^{qu8} \right. \\
& + (3\delta_{m_1 m_4} \delta_{m_2 m_3} - \delta_{m_1 m_2} \delta_{m_3 m_4}) K_{f_1 g_2} (\gamma^\mu P_L)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4} C_{g_2 g_1 f_3 f_4}^{qu8} \left. \left. \right) \right) \\
& - 2i (\delta_{m_1 m_4} \delta_{m_2 m_3} C_{f_1 f_4 f_3 f_2}^{uu} (\gamma^\mu P_R)_{s_1 s_4} (\gamma_\mu P_R)_{s_3 s_2} \\
& - \delta_{m_1 m_2} \delta_{m_3 m_4} C_{f_1 f_2 f_3 f_4}^{uu} (\gamma^\mu P_R)_{s_1 s_2} (\gamma_\mu P_R)_{s_3 s_4})
\end{aligned}$$

### A.13 Baryon and lepton number violating four fermion vertices



$$\begin{aligned}
& -i\epsilon_{m_1 m_2 m_3} U_{g_4 f_4} \left( (P_L)_{s_3 s_4} (P_R)_{s_1 s_2} C_{f_1 f_2 f_3 g_4}^{duq} \right. \\
& + (P_L)_{s_1 s_4} (P_R)_{s_3 s_2} C_{f_3 f_2 f_1 g_4}^{duq} \left. \right) \\
& - i\epsilon_{m_1 m_2 m_3} U_{g_4 f_4} K_{f_2 g_2}^* \left( (P_L)_{s_1 s_4} (P_L)_{s_3 s_2} C_{f_3 g_2 f_1 g_4}^{qqq} \right. \\
& + (P_L)_{s_1 s_2} (P_L)_{s_3 s_4} C_{f_1 g_2 f_3 g_4}^{qqq} \left. \right)
\end{aligned}$$

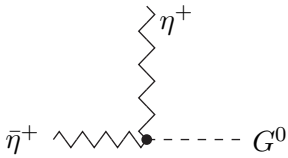
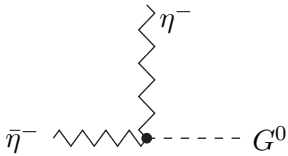


$$+i\epsilon_{m_1 m_2 m_3} (P_L)_{s_1 s_2} (P_L)_{s_3 s_4} U_{g_4 f_4} K_{f_3 g_3}^* \left( C_{f_1 f_2 g_3 g_4}^{qqq} - C_{f_2 f_1 g_3 g_4}^{qqq} \right)$$

$$\begin{aligned} & -i\epsilon_{m_1 m_2 m_3} \left( (P_L)_{s_1 s_4} (P_R)_{s_3 s_2} K_{f_1 g_1}^* C_{f_2 f_3 g_1 f_4}^{duq} \right. \\ & \quad \left. + (P_L)_{s_3 s_4} (P_R)_{s_1 s_2} K_{f_3 g_3}^* C_{f_2 f_1 g_3 f_4}^{duq} \right) \\ & -i\epsilon_{m_1 m_2 m_3} \left( (P_R)_{s_1 s_4} (P_R)_{s_3 s_2} C_{f_2 f_3 f_1 f_4}^{duu} \right. \\ & \quad \left. + (P_R)_{s_1 s_2} (P_R)_{s_3 s_4} C_{f_2 f_1 f_3 f_4}^{duu} \right) \\ & -i\epsilon_{m_1 m_2 m_3} K_{f_1 g_1}^* K_{f_3 g_3}^* \left( (P_L)_{s_1 s_4} (P_L)_{s_3 s_2} C_{g_3 f_2 g_1 f_4}^{qqq} \right. \\ & \quad \left. + (P_L)_{s_1 s_2} (P_L)_{s_3 s_4} C_{g_1 f_2 g_3 f_4}^{qqq} \right) \\ & + 2i\epsilon_{m_1 m_2 m_3} \left( (P_L)_{s_1 s_2} (P_R)_{s_3 s_4} K_{f_1 g_1}^* C_{g_1 f_2 f_3 f_4}^{qqu} \right. \\ & \quad \left. + (P_L)_{s_3 s_2} (P_R)_{s_1 s_4} K_{f_3 g_3}^* C_{g_3 f_2 f_1 f_4}^{qqu} \right) \end{aligned}$$

$$+i\epsilon_{m_1 m_2 m_3} (P_L)_{s_1 s_2} (P_L)_{s_3 s_4} K_{f_1 g_1}^* K_{f_2 g_2}^* \left( C_{g_1 g_2 f_3 f_4}^{qqq} - C_{g_2 g_1 f_3 f_4}^{qqq} \right)$$

#### A.14 Ghost vertices



$$+\frac{1}{4}\bar{g}^2 v \xi_W + \frac{1}{16}\bar{g}^2 v^3 \xi_W C^{\varphi D}$$

$$-\frac{1}{4}\bar{g}^2 v \xi_W - \frac{1}{16}\bar{g}^2 v^3 \xi_W C^{\varphi D}$$

$$\begin{array}{c} \eta_Z \\ \diagup \\ \text{---} \bullet \text{---} \leftarrow \text{---} G^+ \end{array} \quad -\frac{i\bar{g}v\left(\bar{g}'^2-\bar{g}^2\right)\xi_W}{4\sqrt{\bar{g}^2+\bar{g}'^2}}+\frac{i\bar{g}^2\bar{g}'v^3\left(\bar{g}'^2-\bar{g}^2\right)\xi_W}{4\left(\bar{g}^2+\bar{g}'^2\right)^{3/2}}C^{\varphi WB}$$

$$\begin{array}{c} \eta_Z \\ \diagup \\ \text{---} \bullet \text{---} \leftarrow \text{---} G^- \end{array} \quad -\frac{i\bar{g}v\left(\bar{g}'^2-\bar{g}^2\right)\xi_W}{4\sqrt{\bar{g}^2+\bar{g}'^2}}+\frac{i\bar{g}^2\bar{g}'v^3\left(\bar{g}'^2-\bar{g}^2\right)\xi_W}{4\left(\bar{g}^2+\bar{g}'^2\right)^{3/2}}C^{\varphi WB}$$

$$\begin{array}{c} \eta_A \\ \diagup \\ \text{---} \bullet \text{---} \leftarrow \text{---} G^+ \end{array} \quad +\frac{i\bar{g}^2\bar{g}'v\xi_W}{2\sqrt{\bar{g}^2+\bar{g}'^2}}-\frac{i\bar{g}^3\bar{g}'^2v^3\xi_W}{2\left(\bar{g}^2+\bar{g}'^2\right)^{3/2}}C^{\varphi WB}$$

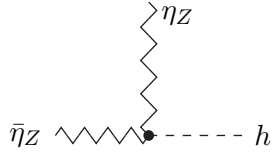
$$\begin{array}{c} \eta_A \\ \diagup \\ \text{---} \bullet \text{---} \leftarrow \text{---} G^- \end{array} \quad +\frac{i\bar{g}^2\bar{g}'v\xi_W}{2\sqrt{\bar{g}^2+\bar{g}'^2}}-\frac{i\bar{g}^3\bar{g}'^2v^3\xi_W}{2\left(\bar{g}^2+\bar{g}'^2\right)^{3/2}}C^{\varphi WB}$$

$$\begin{array}{c} \eta^- \\ \diagup \\ \text{---} \bullet \text{---} \text{---} h \end{array} \quad +\frac{1}{4}i\bar{g}^2v\xi_W-\frac{1}{4}i\bar{g}^2v^3\xi_WC^{\varphi\Box}+\frac{1}{16}i\bar{g}^2v^3\xi_WC^{\varphi D}$$

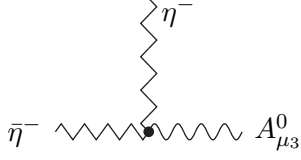
$$\begin{array}{c} \eta^+ \\ \diagup \\ \text{---} \bullet \text{---} \text{---} h \end{array} \quad +\frac{1}{4}i\bar{g}^2v\xi_W-\frac{1}{4}i\bar{g}^2v^3\xi_WC^{\varphi\Box}+\frac{1}{16}i\bar{g}^2v^3\xi_WC^{\varphi D}$$

$$\begin{array}{c} \eta^- \\ \diagup \\ \text{---} \bullet \text{---} \leftarrow \text{---} G^+ \end{array} \quad -\frac{1}{4}i\bar{g}v\sqrt{\bar{g}^2+\bar{g}'^2}\xi_Z+\frac{1}{8}i\bar{g}v^3\sqrt{\bar{g}^2+\bar{g}'^2}\xi_ZC^{\varphi D}-\frac{i\bar{g}^2\bar{g}'v^3\xi_Z}{4\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi WB}$$

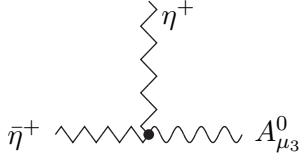
$$\begin{array}{c} \eta^+ \\ \diagup \\ \text{---} \bullet \text{---} \leftarrow \text{---} G^- \end{array} \quad -\frac{1}{4}i\bar{g}v\sqrt{\bar{g}^2+\bar{g}'^2}\xi_Z+\frac{1}{8}i\bar{g}v^3\sqrt{\bar{g}^2+\bar{g}'^2}\xi_ZC^{\varphi D}-\frac{i\bar{g}^2\bar{g}'v^3\xi_Z}{4\sqrt{\bar{g}^2+\bar{g}'^2}}C^{\varphi WB}$$



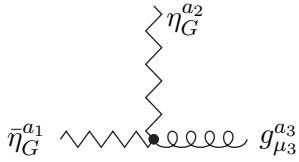
$$+\frac{1}{4}iv\xi_Z\left(\bar{g}^2+\bar{g}'^2\right)-\frac{1}{4}iv^3\xi_Z\left(\bar{g}^2+\bar{g}'^2\right)C^{\varphi\Box}-\frac{1}{16}iv^3\xi_Z\left(\bar{g}^2+\bar{g}'^2\right)C^{\varphi D}+\frac{1}{2}i\bar{g}\bar{g}'v^3\xi_ZC^{\varphi WB}$$



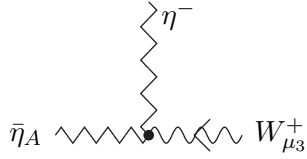
$$+\frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}p_1^{\mu_3}-\frac{i\bar{g}^2\bar{g}'^2v^2}{(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}p_1^{\mu_3}$$



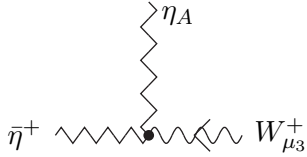
$$-\frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}p_1^{\mu_3}+\frac{i\bar{g}^2\bar{g}'^2v^2}{(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}p_1^{\mu_3}$$



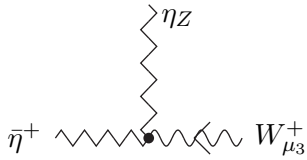
$$-\bar{g}_sf_{a_3a_1a_2}p_1^{\mu_3}$$



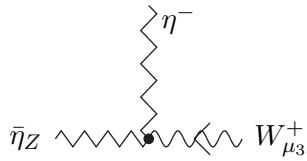
$$-\frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}p_1^{\mu_3}-\frac{i\bar{g}^4v^2}{(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}p_1^{\mu_3}$$



$$+\frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2+\bar{g}'^2}}p_1^{\mu_3}-\frac{i\bar{g}^2\bar{g}'^2v^2}{(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}p_1^{\mu_3}$$



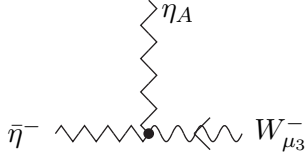
$$+\frac{i\bar{g}^2}{\sqrt{\bar{g}^2+\bar{g}'^2}}p_1^{\mu_3}+\frac{i\bar{g}\bar{g}'^3v^2}{(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}p_1^{\mu_3}$$



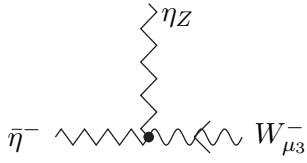
$$-\frac{i\bar{g}^2}{\sqrt{\bar{g}^2+\bar{g}'^2}}p_1^{\mu_3}+\frac{i\bar{g}^3\bar{g}'v^2}{(\bar{g}^2+\bar{g}'^2)^{3/2}}C^{\varphi WB}p_1^{\mu_3}$$



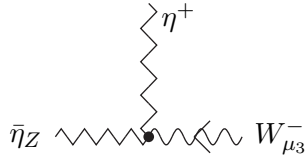
$$+ \frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_1^{\mu_3} + \frac{i\bar{g}^4 v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi W B} p_1^{\mu_3}$$



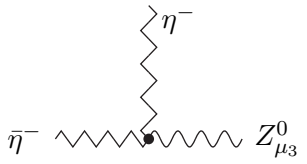
$$- \frac{i\bar{g}\bar{g}'}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_1^{\mu_3} + \frac{i\bar{g}^2 \bar{g}'^2 v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi W B} p_1^{\mu_3}$$



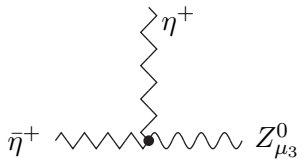
$$- \frac{i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_1^{\mu_3} - \frac{i\bar{g}\bar{g}'^3 v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi W B} p_1^{\mu_3}$$



$$+ \frac{i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_1^{\mu_3} - \frac{i\bar{g}^3 \bar{g}' v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi W B} p_1^{\mu_3}$$



$$+ \frac{i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_1^{\mu_3} + \frac{i\bar{g}\bar{g}'^3 v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi W B} p_1^{\mu_3}$$



$$- \frac{i\bar{g}^2}{\sqrt{\bar{g}^2 + \bar{g}'^2}} p_1^{\mu_3} - \frac{i\bar{g}\bar{g}'^3 v^2}{(\bar{g}^2 + \bar{g}'^2)^{3/2}} C^{\varphi W B} p_1^{\mu_3}$$