

## SM

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[FFS] **2 Leptons – Higgs**

$$C_{82}(\bar{e}_{g1}, e_{g2}, H) = -\frac{ie\delta_{g1,g2}m_{e_{g1}}}{2M_W s_W} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$C_{85}(\bar{e}_{g1}, e_{g2}, G^0) = \frac{e\delta_{g1,g2}m_{e_{g1}}}{2M_W s_W} \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

$$C_{90}(\bar{\nu}_{g1}, e_{g2}, G^+) = -\frac{ie\delta_{g1,g2}m_{e_{g1}}}{\sqrt{2}M_W s_W} \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$C_{91}(\bar{e}_{g1}, \nu_{g2}, G^-) = -\frac{ie\delta_{g1,g2}m_{e_{g1}}}{\sqrt{2}M_W s_W} \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

[FFS] **2 Quarks – Higgs**

$$C_{83}(\bar{u}_{g1}, u_{g2}, H) = -\frac{ie\delta_{g1,g2}m_{u_{g1}}}{2M_W s_W} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$C_{84}(\bar{d}_{g1}, d_{g2}, H) = -\frac{ie\delta_{g1,g2}m_{d_{g1}}}{2M_W s_W} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$C_{86}(\bar{u}_{g1}, u_{g2}, G^0) = \frac{e\delta_{g1,g2}m_{u_{g1}}}{2M_W s_W} \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$$C_{87}(\bar{d}_{g1}, d_{g2}, G^0) = \frac{e\delta_{g1,g2}m_{d_{g1}}}{2M_W s_W} \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

$$C_{88}(\bar{u}_{g1}, d_{g2}, G^+) = \frac{ie\text{CKM}_{g1,g2}}{\sqrt{2}M_W s_W} \begin{bmatrix} m_{u_{g1}} \\ -m_{d_{g2}} \end{bmatrix}$$

$$C_{89}(\bar{d}_{g1}, u_{g2}, G^-) = \frac{ie\text{CKM}_{g2,g1}^*}{\sqrt{2}M_W s_W} \begin{bmatrix} -m_{d_{g1}} \\ m_{u_{g2}} \end{bmatrix}$$

**[FFV] 2 Leptons – Gauge Boson**

$$C_{71}(\bar{e}_{g1}, e_{g2}, \gamma) = ie\delta_{g1,g2} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$C_{74}(\bar{\nu}_{g1}, \nu_{g2}, Z) = \frac{ie\delta_{g1,g2}}{2c_W s_W} \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$C_{75}(\bar{e}_{g1}, e_{g2}, Z) = \frac{ie\delta_{g1,g2}}{c_W} \begin{bmatrix} -\frac{1}{s_W} \left( \frac{1}{2} - s_W^2 \right) \\ s_W \end{bmatrix}$$

$$C_{78}(\bar{\nu}_{g1}, e_{g2}, W^+) = \frac{ie\delta_{g1,g2}}{\sqrt{2}s_W} \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$C_{79}(\bar{e}_{g1}, \nu_{g2}, W^-) = \frac{ie\delta_{g1,g2}}{\sqrt{2}s_W} \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

[FFV] **2 Quarks – Gauge Boson**

$$C_{72}(\bar{u}_{g1}, u_{g2}, \gamma) = -\frac{2}{3}ie\delta_{g1,g2} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$C_{73}(\bar{d}_{g1}, d_{g2}, \gamma) = \frac{1}{3}ie\delta_{g1,g2} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$C_{76}(\bar{u}_{g1}, u_{g2}, Z) = \frac{ie\delta_{g1,g2}}{c_W} \begin{bmatrix} \frac{1}{s_W} \left( \frac{1}{2} - \frac{2}{3}s_W^2 \right) \\ -\frac{2s_W}{3} \end{bmatrix}$$

$$C_{77}(\bar{d}_{g1}, d_{g2}, Z) = \frac{ie\delta_{g1,g2}}{c_W} \begin{bmatrix} -\frac{1}{s_W} \left( \frac{1}{2} - \frac{1}{3}s_W^2 \right) \\ \frac{s_W}{3} \end{bmatrix}$$

$$C_{80}(\bar{u}_{g1}, d_{g2}, W^+) = \frac{ie\text{CKM}_{g1,g2}}{\sqrt{2}s_W} \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$C_{81}(\bar{d}_{g1}, u_{g2}, W^-) = \frac{ie\text{CKM}_{g2,g1}^*}{\sqrt{2}s_W} \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

[SSS] **3 Higgs**

$$C_{34}(H, H, H) = \begin{bmatrix} -\frac{3ieM_H^2}{2M_W s_W} \end{bmatrix}$$

$$C_{35}(H, G^0, G^0) = \begin{bmatrix} -\frac{ieM_H^2}{2M_W s_W} \end{bmatrix}$$

$$C_{36}(G^-, H, G^+) = \left[ -\frac{ieM_H^2}{2M_W s_W} \right]$$

[SSV] **2 Higgs – Gauge Boson**

$$C_{56}(G^0, H, Z) = \left[ \frac{e}{2c_W s_W} \right]$$

$$C_{57}(G^+, G^-, \gamma) = \left[ -ie \right]$$

$$C_{58}(G^+, G^-, Z) = \left[ \frac{ie}{2c_W s_W} (c_W^2 - s_W^2) \right]$$

$$C_{59}(G^-, H, W^+) = \left[ -\frac{ie}{2s_W} \right]$$

$$C_{60}(G^+, H, W^-) = \left[ \frac{ie}{2s_W} \right]$$

$$C_{61}(G^-, G^0, W^+) = \left[ \frac{e}{2s_W} \right]$$

$$C_{62}(G^+, G^0, W^-) = \left[ \frac{e}{2s_W} \right]$$

[SUU] **Higgs – 2 Ghosts**

$$C_{105}(H, \bar{u}_Z, u_Z) = \left[ -\frac{ie\xi_Z M_Z}{2c_W s_W} \right]$$

$$C_{106}(H, \bar{u}_-, u_-) = \left[ -\frac{ie\xi_W M_W}{2s_W} \right]$$

$$C_{107}(H, \bar{u}_+, u_+) = \left[ -\frac{ie\xi_W M_W}{2s_W} \right]$$

$$C_{108}(G^0, \bar{u}_+, u_+) = \left[ \frac{e\xi_W M_W}{2s_W} \right]$$

$$_{109} C \left( G^0, \bar{u}_-, u_- \right) = \left[ -\frac{e\xi_W M_W}{2s_W} \right]$$

$$_{110} C \left( G^+, \bar{u}_Z, u_- \right) = \left[ \frac{ie\xi_Z M_Z}{2s_W} \right]$$

$$_{111} C \left( G^-, \bar{u}_Z, u_+ \right) = \left[ \frac{ie\xi_Z M_Z}{2s_W} \right]$$

$$_{112} C \left( G^+, \bar{u}_+, u_Z \right) = \left[ -\frac{ie\xi_W M_W}{2c_W s_W} \left( c_W^2 - s_W^2 \right) \right]$$

$$_{113} C \left( G^-, \bar{u}_-, u_Z \right) = \left[ -\frac{ie\xi_W M_W}{2c_W s_W} \left( c_W^2 - s_W^2 \right) \right]$$

$$_{114} C \left( G^+, \bar{u}_+, u_\gamma \right) = \left[ ie\xi_W M_W \right]$$

$$_{115} C \left( G^-, \bar{u}_-, u_\gamma \right) = \left[ ie\xi_W M_W \right]$$

[SVV] **Higgs – 2 Gauge Bosons**

$$_{63} C \left( H, W^+, W^- \right) = \left[ \frac{ieM_W}{s_W} \right]$$

$$_{64} C \left( H, Z, Z \right) = \left[ \frac{ieM_W}{s_W c_W^2} \right]$$

$$_{66} C \left( G^+, W^-, Z \right) = \left[ -\frac{ieM_W s_W}{c_W} \right]$$

$$_{67} C \left( G^-, W^+, Z \right) = \left[ -\frac{ieM_W s_W}{c_W} \right]$$

$$_{68} C \left( G^+, W^-, \gamma \right) = \left[ -ieM_W \right]$$

$$_{69} C \left( G^-, W^+, \gamma \right) = \left[ -ieM_W \right]$$

[UVV] 2 Ghosts – Gauge Boson

$$C_{92}(\bar{u}_-, u_-, \gamma) = -ie \begin{bmatrix} 1 \\ \hline 0 \end{bmatrix}$$

$$C_{93}(\bar{u}_+, u_+, \gamma) = ie \begin{bmatrix} 1 \\ \hline 0 \end{bmatrix}$$

$$C_{94}(\bar{u}_-, u_-, Z) = \frac{iec_W}{s_W} \begin{bmatrix} 1 \\ \hline 0 \end{bmatrix}$$

$$C_{95}(\bar{u}_+, u_+, Z) = -\frac{iec_W}{s_W} \begin{bmatrix} 1 \\ \hline 0 \end{bmatrix}$$

$$C_{96}(\bar{u}_-, u_Z, W^-) = -\frac{iec_W}{s_W} \begin{bmatrix} 1 \\ \hline 0 \end{bmatrix}$$

$$C_{97}(\bar{u}_Z, u_-, W^+) = -\frac{iec_W}{s_W} \begin{bmatrix} 1 \\ \hline 0 \end{bmatrix}$$

$$C_{98}(\bar{u}_+, u_Z, W^+) = \frac{iec_W}{s_W} \begin{bmatrix} 1 \\ \hline 0 \end{bmatrix}$$

$$C_{99}(\bar{u}_Z, u_+, W^-) = \frac{iec_W}{s_W} \begin{bmatrix} 1 \\ \hline 0 \end{bmatrix}$$

$$_{100} C(\bar{u}_-, u_\gamma, W^-) = ie \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$_{101} C(\bar{u}_\gamma, u_-, W^+) = ie \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$_{102} C(\bar{u}_+, u_\gamma, W^+) = -ie \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$_{103} C(\bar{u}_\gamma, u_+, W^-) = -ie \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

### [VVV] 3 Gauge Bosons

$$_{26} C(\gamma, W^+, W^-) = \begin{bmatrix} -ie \end{bmatrix}$$

$$_{27} C(Z, W^+, W^-) = \begin{bmatrix} \frac{ie c_W}{s_W} \end{bmatrix}$$

### [SSSS] 4 Higgs

$$_{28} C(H, H, H, H) = \begin{bmatrix} -\frac{3ie^2 M_H^2}{4M_W^2 s_W^2} \end{bmatrix}$$

$$_{29} C(H, H, G^0, G^0) = \begin{bmatrix} -\frac{ie^2 M_H^2}{4M_W^2 s_W^2} \end{bmatrix}$$

$$_{30} C(H, H, G^-, G^+) = \begin{bmatrix} -\frac{ie^2 M_H^2}{4M_W^2 s_W^2} \end{bmatrix}$$



$$C_{31}(G^0, G^0, G^0, G^0) = \left[ -\frac{3ie^2 M_H^2}{4M_W^2 s_W^2} \right]$$

$$C_{32}(G^0, G^0, G^-, G^+) = \left[ -\frac{ie^2 M_H^2}{4M_W^2 s_W^2} \right]$$

$$C_{33}(G^-, G^-, G^+, G^+) = \left[ -\frac{ie^2 M_H^2}{2M_W^2 s_W^2} \right]$$

**[SSVV] 2 Higgs – 2 Gauge Bosons**

$$C_{37}(H, H, W^-, W^+) = \left[ \frac{ie^2}{2s_W^2} \right]$$

$$C_{38}(G^0, G^0, W^-, W^+) = \left[ \frac{ie^2}{2s_W^2} \right]$$

$$C_{39}(G^-, G^+, W^-, W^+) = \left[ \frac{ie^2}{2s_W^2} \right]$$

$$C_{40}(G^-, G^+, Z, Z) = \left[ \frac{ie^2}{2c_W^2 s_W^2} (c_W^2 - s_W^2)^2 \right]$$

$$C_{41}(G^-, G^+, \gamma, Z) = \left[ -\frac{ie^2}{c_W s_W} (c_W^2 - s_W^2) \right]$$

$$C_{42}(G^-, G^+, \gamma, \gamma) = \left[ 2ie^2 \right]$$

$$C_{43}(H, H, Z, Z) = \left[ \frac{ie^2}{2c_W^2 s_W^2} \right]$$

$$C_{44}(G^0, G^0, Z, Z) = \left[ \frac{ie^2}{2c_W^2 s_W^2} \right]$$

$$C_{47}(H, G^+, W^-, Z) = \left[ -\frac{ie^2}{2c_W} \right]$$

$$C_{48}(H, G^-, W^+, Z) = \left[ -\frac{ie^2}{2c_W} \right]$$

$$C_{49}(H, G^-, W^+, \gamma) = \left[ -\frac{ie^2}{2s_W} \right]$$

$$C_{50}(H, G^+, W^-, \gamma) = \left[ -\frac{ie^2}{2s_W} \right]$$

$$C_{51}(G^-, G^0, Z, W^+) = \left[ \frac{e^2}{2c_W} \right]$$

$$C_{52}(G^+, G^0, Z, W^-) = \left[ -\frac{e^2}{2c_W} \right]$$

$$C_{53}(G^-, G^0, \gamma, W^+) = \left[ \frac{e^2}{2s_W} \right]$$

$$C_{54}(G^+, G^0, \gamma, W^-) = \left[ -\frac{e^2}{2s_W} \right]$$

#### [VVVV] 4 Gauge Bosons

$$C_{22}(W^+, W^+, W^-, W^-) = \frac{ie^2}{s_W^2} \begin{bmatrix} 2 \\ -1 \\ -1 \end{bmatrix}$$

$$C_{23}(W^+, W^-, Z, Z) = \frac{ie^2 c_W^2}{s_W^2} \begin{bmatrix} -2 \\ 1 \\ 1 \end{bmatrix}$$

$$C_{24}(W^+, W^-, \gamma, Z) = \frac{ie^2 c_W}{s_W} \begin{bmatrix} 2 \\ -1 \\ -1 \end{bmatrix}$$

$$C_{25}(W^+, W^-, \gamma, \gamma) = ie^2 \begin{bmatrix} -2 \\ 1 \\ 1 \end{bmatrix}$$