

$$C(V_\mu, V_\nu, V_\rho, V_\sigma) = \vec{G}_{VVVV} \cdot \begin{pmatrix} g_{\mu\nu}g_{\rho\sigma} \\ g_{\mu\rho}g_{\nu\sigma} \\ g_{\mu\sigma}g_{\nu\rho} \end{pmatrix}_+ \quad (VVVV)$$

$$C(V_\mu(k_1), V_\nu(k_2), V_\rho(k_3)) = \vec{G}_{VVV} \cdot (g_{\mu\nu}(k_2 - k_1)_\rho + g_{\nu\rho}(k_3 - k_2)_\mu + g_{\rho\mu}(k_1 - k_3)_\nu)_- \quad (VVV)$$

$$C(S, S, S, S) = \vec{G}_{SSSS} \cdot (1)_+ \quad (SSSS)$$

$$C(S, S, S) = \vec{G}_{SSS} \cdot (1)_+ \quad (SSS)$$

$$C(S, S, V_\mu, V_\nu) = \vec{G}_{SSVV} \cdot (g_{\mu\nu})_+ \quad (SSVV)$$

$$C(S(k_1), S(k_2), V_\mu) = \vec{G}_{SSV} \cdot ((k_1 - k_2)_\mu)_- \quad (SSV)$$

$$C(S, V_\mu, V_\nu) = \vec{G}_{SVV} \cdot (g_{\mu\nu})_+ \quad (SVV)$$

$$C(F, F, V_\mu) = \vec{G}_{FFV} \cdot \begin{pmatrix} \gamma_\mu \omega_- \\ \gamma_\mu \omega_+ \end{pmatrix}_+ \quad (FFV)$$

$$C(F, F, S) = \vec{G}_{FFS} \cdot \begin{pmatrix} \omega_- \\ \omega_+ \end{pmatrix}_+ \quad (FFS)$$

$$C(U(k_1), U(k_2), V_\mu) = \vec{G}_{UUV} \cdot \begin{pmatrix} k_{1\mu} \\ k_{2\mu} \end{pmatrix}_+ \quad (UUV)$$

$$C(S, U, U) = \vec{G}_{SUU} \cdot (1)_+ \quad (SUU)$$

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[FFS] 2 Leptons – Higgs

$$C_{82}(\bar{e}_{j1}, e_{j2}, H) = \begin{bmatrix} -\frac{i e \delta_{j1,j2} m_{e_{j1}}}{2 M_W s_W} \\ -\frac{i e \delta_{j1,j2} m_{e_{j1}}}{2 M_W s_W} \end{bmatrix}$$

$$C_{85}(\bar{e}_{j1}, e_{j2}, G^0) = \begin{bmatrix} -\frac{e \delta_{j1,j2} m_{e_{j1}}}{2 M_W s_W} \\ \frac{e \delta_{j1,j2} m_{e_{j1}}}{2 M_W s_W} \end{bmatrix}$$

$$C_{90}(\bar{\nu}_{j1}, e_{j2}, G^+) = \begin{bmatrix} 0 \\ -\frac{i e \delta_{j1,j2} m_{e_{j1}}}{\sqrt{2} M_W s_W} \end{bmatrix}$$

$$C_{91}(\bar{e}_{j1}, \nu_{j2}, G^-) = \begin{bmatrix} -\frac{i e \delta_{j1,j2} m_{e_{j1}}}{\sqrt{2} M_W s_W} \\ 0 \end{bmatrix}$$

[FFS] 2 Quarks – Higgs

$$C_{83}(\bar{u}_{j1}, u_{j2}, H) = \begin{bmatrix} -\frac{i e \delta_{j1,j2} m_{u_{j1}}}{2 M_W s_W} \\ -\frac{i e \delta_{j1,j2} m_{u_{j1}}}{2 M_W s_W} \end{bmatrix}$$

$$C_{84}(\bar{d}_{j1}, d_{j2}, H) = \begin{bmatrix} -\frac{i e \delta_{j1,j2} m_{d_{j1}}}{2 M_W s_W} \\ -\frac{i e \delta_{j1,j2} m_{d_{j1}}}{2 M_W s_W} \end{bmatrix}$$

$$C_{86}(\bar{u}_{j1}, u_{j2}, G^0) = \begin{bmatrix} \frac{e \delta_{j1,j2} m_{u_{j1}}}{2 M_W s_W} \\ -\frac{e \delta_{j1,j2} m_{u_{j1}}}{2 M_W s_W} \end{bmatrix}$$

$$C_{87}(\bar{d}_{j1}, d_{j2}, G^0) = \begin{bmatrix} -\frac{e \delta_{j1,j2} m_{d_{j1}}}{2 M_W s_W} \\ \frac{e \delta_{j1,j2} m_{d_{j1}}}{2 M_W s_W} \end{bmatrix}$$

$$C_{88}(\bar{u}_{j1}, d_{j2}, G^+) = \begin{bmatrix} \frac{i e m_{u_{j1}} \text{CKM}_{j1,j2}}{\sqrt{2} M_W s_W} \\ -\frac{i e m_{d_{j2}} \text{CKM}_{j1,j2}}{\sqrt{2} M_W s_W} \end{bmatrix}$$

$$C_{89}(\bar{d}_{j2}, u_{j1}, G^-) = \begin{bmatrix} -\frac{i e m_{d_{j2}} \text{CKM}_{j1,j2}^*}{\sqrt{2} M_W s_W} \\ \frac{i e m_{u_{j1}} \text{CKM}_{j1,j2}^*}{\sqrt{2} M_W s_W} \end{bmatrix}$$

[FFV] 2 Leptons – Gauge Boson

$$C_{71}(\bar{e}_{j1}, e_{j2}, \gamma) = \begin{bmatrix} i e \delta_{j1,j2} \\ i e \delta_{j1,j2} \end{bmatrix}$$

$$C_{74}(\bar{\nu}_{j1}, \nu_{j2}, Z) = \begin{bmatrix} \frac{i e \delta_{j1,j2}}{2 c_W s_W} \\ 0 \end{bmatrix}$$

$$C_{75}(\bar{e}_{j1}, e_{j2}, Z) = \begin{bmatrix} -\frac{i e \delta_{j1,j2}}{c_W s_W} \left(\frac{1}{2} - s_W^2 \right) \\ \frac{i e \delta_{j1,j2} s_W}{c_W} \end{bmatrix}$$

$$C_{78}(\bar{\nu}_{j1}, e_{j2}, W^+) = \begin{bmatrix} \frac{i e \delta_{j1,j2}}{\sqrt{2} s_W} \\ 0 \end{bmatrix}$$

$$C_{79}(\bar{e}_{j1}, \nu_{j2}, W^-) = \begin{bmatrix} \frac{i e \delta_{j1,j2}}{\sqrt{2} s_W} \\ 0 \end{bmatrix}$$

[FFV] 2 Quarks – Gauge Boson

$$C_{72}(\bar{u}_{j1}, u_{j2}, \gamma) = \begin{bmatrix} -\frac{2 i e \delta_{j1,j2}}{3} \\ -\frac{2 i e \delta_{j1,j2}}{3} \end{bmatrix}$$

$$C_{73}(\bar{d}_{j1}, d_{j2}, \gamma) = \begin{bmatrix} \frac{i e \delta_{j1,j2}}{3} \\ \frac{i e \delta_{j1,j2}}{3} \end{bmatrix}$$

$$C_{76}(\bar{u}_{j1}, u_{j2}, Z) = \begin{bmatrix} \frac{i e \delta_{j1,j2}}{c_W s_W} \left(\frac{1}{2} - \frac{2 s_W^2}{3} \right) \\ -\frac{2 i e \delta_{j1,j2} s_W}{3 c_W} \end{bmatrix}$$

$$C_{77}(\bar{d}_{j1}, d_{j2}, Z) = \begin{bmatrix} -\frac{i e \delta_{j1,j2}}{c_W s_W} \left(\frac{1}{2} - \frac{s_W^2}{3} \right) \\ \frac{i e \delta_{j1,j2} s_W}{3 c_W} \end{bmatrix}$$

$$C_{80}(\bar{u}_{j1}, d_{j2}, W^+) = \begin{bmatrix} \frac{i e \text{CKM}_{j1,j2}}{\sqrt{2} s_W} \\ 0 \end{bmatrix}$$

$$C_{81}(\bar{d}_{j2}, u_{j1}, W^-) = \begin{bmatrix} \frac{i e \text{CKM}_{j1,j2}^*}{\sqrt{2} s_W} \\ 0 \end{bmatrix}$$

[SSS] 3 Higgs

$$C_{34}(H, H, H) = -\frac{3 i e M_H^2}{2 M_W s_W}$$

$$C_{35}(H, G^0, G^0) = -\frac{i e M_H^2}{2 M_W s_W}$$

$$C_{36}(G^-, H, G^+) = -\frac{i e M_H^2}{2 M_W s_W}$$

[SSSS] 4 Higgs

$$C_{28}(H, H, H, H) = -\frac{3 i e^2 M_H^2}{4 M_W^2 s_W^2}$$

$$C_{29}(H, H, G^0, G^0) = -\frac{i e^2 M_H^2}{4 M_W^2 s_W^2}$$

$$C_{30}(H, H, G^-, G^+) = -\frac{i e^2 M_H^2}{4 M_W^2 s_W^2}$$

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

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

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

[SSV] 2 Higgs – Gauge Boson

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

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

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

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

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

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

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

[SSVV] 2 Higgs – 2 Gauge Bosons

$$C(H, H, W^-, W^+) = \frac{ie^2}{2s_W^2}$$

$$C(G^0, G^0, W^-, W^+) = \frac{ie^2}{2s_W^2}$$

$$C(G^-, G^+, W^-, W^+) = \frac{ie^2}{2s_W^2}$$

$$C(G^-, G^+, Z, Z) = \frac{ie^2}{2c_W^2 s_W^2} (c_W^2 - s_W^2)^2$$

$$C(G^-, G^+, \gamma, Z) = -\frac{ie^2}{c_W s_W} (c_W^2 - s_W^2)$$

$$C(G^-, G^+, \gamma, \gamma) = 2ie^2$$

$$C(H, H, Z, Z) = \frac{ie^2}{2c_W^2 s_W^2}$$

$$C(G^0, G^0, Z, Z) = \frac{ie^2}{2c_W^2 s_W^2}$$

$$C(H, G^+, W^-, Z) = -\frac{ie^2}{2c_W}$$

$$C(H, G^-, W^+, Z) = -\frac{ie^2}{2c_W}$$

$$C(H, G^-, W^+, \gamma) = -\frac{ie^2}{2s_W}$$

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

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

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

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

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

[SUU] Higgs – 2 Ghosts

$$C_{104}(H, \bar{u}_Z, u_Z) = -\frac{ieM_Z\xi_Z}{2c_Ws_W}$$

$$C_{105}(H, \bar{u}_-, u_-) = -\frac{ieM_W\xi_W}{2s_W}$$

$$C_{106}(H, \bar{u}_+, u_+) = -\frac{ieM_W\xi_W}{2s_W}$$

$$C_{107}(G^0, \bar{u}_+, u_+) = \frac{eM_W\xi_W}{2s_W}$$

$$C_{108}(G^0, \bar{u}_-, u_-) = -\frac{eM_W\xi_W}{2s_W}$$

$$C_{109}(G^+, \bar{u}_Z, u_-) = \frac{ieM_Z\xi_Z}{2s_W}$$

$$C_{110}(G^-, \bar{u}_Z, u_+) = \frac{ieM_Z\xi_Z}{2s_W}$$

$$C_{111}(G^+, \bar{u}_+, u_Z) = -\frac{ie M_W \xi_W}{2 c_W s_W} (c_W^2 - s_W^2)$$

$$C_{112}(G^-, \bar{u}_-, u_Z) = -\frac{ie M_W \xi_W}{2 c_W s_W} (c_W^2 - s_W^2)$$

$$C_{113}(G^+, \bar{u}_+, u_\gamma) = ie M_W \xi_W$$

$$C_{114}(G^-, \bar{u}_-, u_\gamma) = ie M_W \xi_W$$

[SVV] Higgs – 2 Gauge Bosons

$$C_{63}(H, W^+, W^-) = \frac{ie M_W}{s_W}$$

$$C_{64}(H, Z, Z) = \frac{ie M_W}{c_W^2 s_W}$$

$$C_{66}(G^+, W^-, Z) = -\frac{ie M_W s_W}{c_W}$$

$$C_{67}(G^-, W^+, Z) = -\frac{ie M_W s_W}{c_W}$$

$$C_{68}(G^+, W^-, \gamma) = -ie M_W$$

$$C_{69}(G^-, W^+, \gamma) = -ie M_W$$

[UUV] 2 Ghosts – Gauge Boson

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

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

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

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

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

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

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

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

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

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

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

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

[VVV] 3 Gauge Bosons

$$C_{26}(\gamma, W^+, W^-) = -ie$$

$$C_{27}(Z, W^+, W^-) = \frac{ie c_W}{s_W}$$

[VVVV] 4 Gauge Bosons

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

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

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

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