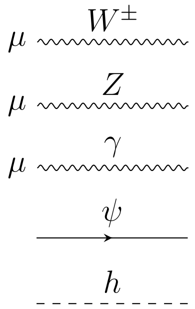
Note, that an excellent reference is PDG, specifically the chapters.

- Kinematics
- Electroweak Model and Constraints on New Physics

The notations in this appendix follow the book "An Introduction to Quantum Field Theory" by M. Peskin and D. Schroeder.

Electroweak Feynman Rules in the Unitary Gauge (one fermionic generation)

Propagators:



$W^\pm$: $\frac{-i}{p^2-m_W^2}\left(g_{\mu\nu}-\frac{p_\mu p_\nu}{m_W^2}\right)$

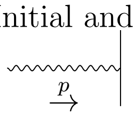
Z: $\frac{-i}{p^2-m_Z^2}\left(g_{\mu\nu}-\frac{p_\mu p_\nu}{m_z^2}\right)$

γ: $\frac{-i}{p^2}g_{\mu\nu}$

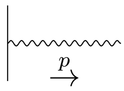
ψ: $\frac{i(\not p+m_\psi)}{p^2-m_\psi^2}$ (for any fermion ψ)

h: $\frac{i}{p^2-m_H^2}$

Initial and final lines



$\epsilon_\mu(p)$ incoming



$\epsilon^*_\mu(p)$ outgoing

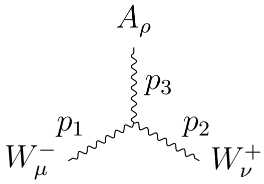
Summation over polarizations:

$$\sum_{\text{polarizations}} \epsilon_\mu(p)\epsilon^*_\nu(p) = -g_{\mu\nu} \text{ for photons}$$

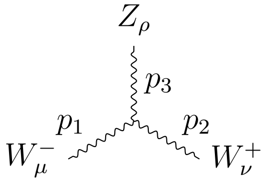
$$\sum_{\text{polarizations}} \epsilon_\mu(p)\epsilon^*_\nu(p) = -g_{\mu\nu} + \frac{p_\mu p_\nu}{m^2} \text{ for massive vectors}$$

$$\sum_{\text{spins}} u(p)\bar{u}(p) = \not p + m, \qquad \sum_{\text{spins}} v(p)\bar{v}(p) = \not p - m$$

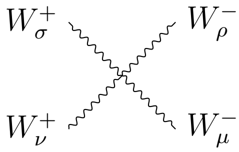
Vertices (all momenta are incoming):
Gauge boson self interactions



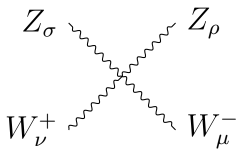
$$ig \sin\theta_W((p_1 - p_2)_\rho g_{\mu\nu} + (p_2 - p_3)_\mu g_{\nu\rho} + (p_3 - p_1)_\nu g_{\rho\mu})$$



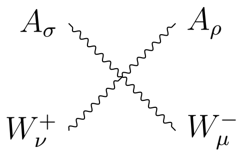
$$ig \cos\theta_W((p_1 - p_2)_\rho g_{\mu\nu} + (p_2 - p_3)_\mu g_{\nu\rho} + (p_3 - p_1)_\nu g_{\rho\mu})$$



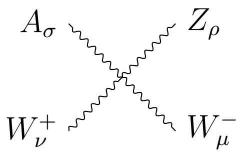
$$ig^2(2g_{\mu\rho}g_{\nu\sigma} - g_{\mu\nu}g_{\rho\sigma} - g_{\mu\sigma}g_{\nu\rho})$$



$$ig^2 \cos^2\theta_W(2g_{\mu\nu}g_{\rho\sigma} - g_{\mu\rho}g_{\nu\sigma} - g_{\mu\sigma}g_{\nu\rho})$$

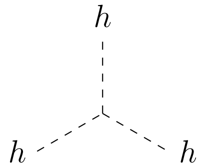


$$ig^2 \sin^2\theta_W(2g_{\mu\nu}g_{\rho\sigma} - g_{\mu\rho}g_{\nu\sigma} - g_{\mu\sigma}g_{\nu\rho})$$

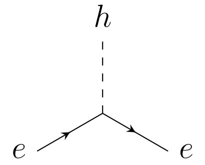


$$ig^2 \cos\theta_W \sin\theta_W(2g_{\mu\nu}g_{\rho\sigma} - g_{\mu\rho}g_{\nu\sigma} - g_{\mu\sigma}g_{\nu\rho})$$

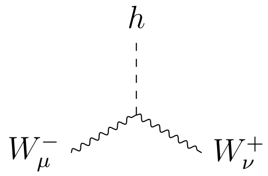
Higgs interactions



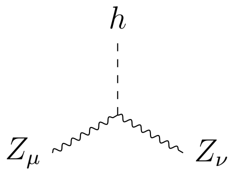
$$i\tfrac{3}{2}g\tfrac{m_H^2}{m_W}$$



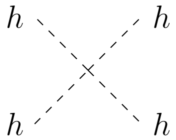
$$-ig\tfrac{m_e}{M_W}$$



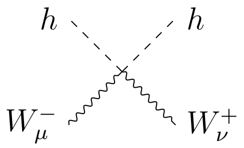
$$igM_W g_{\mu\nu}$$



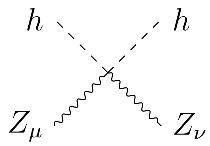
$$i\tfrac{gM_W}{\cos^2\theta_W}g_{\mu\nu}$$



$$-i\tfrac{3}{4}\tfrac{m_H^2}{m_W^2}$$

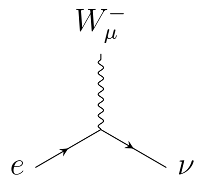


$$i\tfrac{g^2}{2}g_{\mu\nu}$$

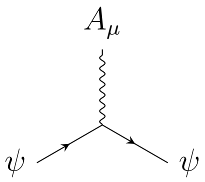


$$i\tfrac{g^2}{2\cos^2\theta_W}g_{\mu\nu}$$

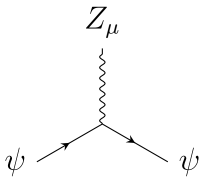
Fermion interactions with gauge bosons



$-i\frac{g}{2\sqrt{2}}\gamma_\mu(1-\gamma^5)$

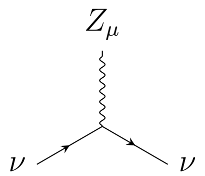


$+iQg\sin\theta_W\gamma_\mu$ — Q is the fermion charge in units of e



$+i\frac{g}{2\cos\theta_W}\gamma_\mu(T^3(1-\gamma^5)-2Q\sin^2\theta_W)$ — $T^3 = 1/2$ for up quarks and neutrinos,

$-1/2$ for down quarks and charged lepto



$-i\frac{g}{4\cos\theta_W}\gamma_\mu(1-\gamma^5)$

Some formulas for traces of gamma matrices

$$
\begin{aligned}
\mathrm{tr}(\mathbf{1}) &= 4 \\
\mathrm{tr}(\text{odd number of } \gamma matrices) &= 0 \\
\mathrm{tr}(\gamma^\mu \gamma \nu) &= 4 g^{\mu\nu} \\
\mathrm{tr}(\gamma^\mu \gamma^\nu \gamma^\rho \gamma^\sigma) &= 4(g^{\mu\nu} g^{\rho\sigma} - g^{\mu\rho} g^{\nu\sigma} + g^{\mu\sigma} g^{\nu\rho}) \\
\mathrm{tr}(\gamma^5) &= 0 \\
\mathrm{tr}(\gamma^5 \gamma^\mu \gamma^\nu) &= 0 \text{ (proove it!)} \\
\mathrm{tr}(\gamma^5 \gamma^\mu \gamma^\nu \gamma^\rho \gamma^\sigma) &= -4i \epsilon^{\mu\nu\rho\sigma} \\
\epsilon^{\alpha\beta\gamma\delta} \epsilon_{\alpha\beta\gamma\delta} &= -24 \\
\epsilon^{\alpha\beta\gamma\mu} \epsilon_{\alpha\beta\gamma\nu} &= -6 \delta^\mu_\nu \\
\epsilon^{\alpha\beta\mu\nu} \epsilon_{\alpha\beta\rho\sigma} &= -2(\delta^\mu_\rho \delta^\nu_\sigma - \delta^\mu_\sigma \delta^\nu_\rho)
\end{aligned}
$$