

Standard Model

$$\mathcal{L} \sim -\frac{1}{4} B_{\mu\nu} B^{\mu\nu} - \frac{1}{4} W_{\mu\nu}^a W^{a\mu\nu} - \frac{1}{4} G_{\mu\nu}^a G^{a\mu\nu}$$

gauge-kinetic terms

$$+ Q_L^{+i} i \bar{\sigma}^\mu D_\mu Q_L^i + L_L^{+i} i \bar{\sigma}^\mu D_\mu L_L^i$$

← flavor index

$$+ D_R^{+i} i \bar{\sigma}^\mu D_\mu D_R^i + U_R^{+i} i \bar{\sigma}^\mu D_\mu U_R^i + E_R^{+i} i \bar{\sigma}^\mu D_\mu E_R^i$$

fermion kinetic terms

$$+ D_\mu H^\dagger D^\mu H - \frac{\lambda}{2} \left(H^\dagger H - \frac{v^2}{2} \right)^2$$

Higgs kinetic + potential

$$+ \lambda^D Q_L^\dagger H D_R + \lambda^U Q_L^\dagger \tilde{H} U_R + \lambda^E Q_L^\dagger H E_R$$

Yukawas

$$+ \left[\begin{array}{l} N_R^{+i} i \bar{\sigma}^\mu D_\mu N_R^i + \lambda^N L_L^{+i} \tilde{H} N_R^i \quad \text{Dirac} \\ \text{or} \\ \kappa^i \frac{(L_L^\dagger \tilde{H})(L_L^\dagger \tilde{H})}{M} \end{array} \right]$$

neutrino mass
Majorana

$$+ \theta_{QCD} G_{\mu\nu} G_{\alpha\beta} \epsilon^{\mu\nu\alpha\beta}$$

$$\theta_{QCD} < 10^{-10} \quad \text{strong CP problem}$$

$$+ \Lambda_{cc}^4$$

$$\Lambda_{cc} \approx 10^{-4} \text{ eV} \quad \text{cosmological constant problem}$$

$$V \approx 246 \text{ GeV} \ll M_{Pl} \quad \text{hierarchy problem}$$