1 SM Lagrangian - fermion sector

1 generation, 1 color:

$$\mathcal{L}_f^{quark} = (\bar{Q}_L, \bar{Q}_R) \begin{pmatrix} i\not{D}_L^{quark} & 0 \\ 0 & i\not{D}_R^{quark} \end{pmatrix} \begin{pmatrix} Q_L \\ Q_R \end{pmatrix} = \bar{Q}_L i\not{D}_L^{quark} Q_L + \bar{Q}_R i\not{D}_R^{quark} Q_R, \tag{1}$$

$$\mathcal{L}_f^{lept} = (\bar{L}_L, \bar{L}_R) \begin{pmatrix} i\not{D}_L^{lept} & 0 \\ 0 & i\not{D}_R^{lept} \end{pmatrix} \begin{pmatrix} L_L \\ L_R \end{pmatrix} = \bar{L}_L i\not{D}_L^{lept} L_L + \bar{L}_R i\not{D}_R^{lept} L_R, \tag{2}$$

where

$$Q_{L,R} = \begin{pmatrix} u_{L,R} \\ d_{L,R} \end{pmatrix}, \quad L_{L,R} = \begin{pmatrix} \nu_{L,R} \\ e_{L,R} \end{pmatrix}, \tag{3}$$

and $\psi_{L,R} = (1 \mp \gamma_5)/2$, where $\psi \in \{u, d, \nu, e\}$. The covariant derivatives are given as

$$\begin{aligned} \not{D}_L^{quark,lept} &= \mathcal{I}_2 \otimes \not{\partial} + ig\tau^a \otimes \not{W}^a + \frac{i}{2} g' Y_L^{quark,lept} \otimes \not{B}, && (4) \\ \not{D}_R^{quark,lept} &= \mathcal{I}_2 \otimes \not{\partial} + \frac{i}{2} g' Y_R^{quark,lept} \otimes \not{B}, && (5) \end{aligned}$$

where

$$Y_L^{quark} = \begin{pmatrix} 1/3 & 0 \\ 0 & 4/3 \end{pmatrix}, Y_R^{quark} = \begin{pmatrix} 1/3 & 0 \\ 0 & -2/3 \end{pmatrix}, Y_L^{lept} = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}, Y_R^{lept} = \begin{pmatrix} 0 & 0 \\ 0 & -2 \end{pmatrix}, \tag{6}$$

and $\mathcal{I}_2$ is a 2×2 unit matrix.

After breaking down the Lagrangians we get

$$\begin{aligned} \mathcal{L}_f^{quark} &= \bar{u}_L i\not{\partial} u_L + \bar{u}_R i\not{\partial} u_R + \bar{d}_L i\not{\partial} d_L + \bar{d}_R i\not{\partial} d_R \\ &\quad -\bar{u}_L(\frac{1}{2} g\not{W}^3 + \frac{1}{6} g'\not{B})u_L - \bar{u}_R(\frac{1}{6} g'\not{B})u_R \\ &\quad +\bar{d}_L(\frac{1}{2} g\not{W}^3 - \frac{2}{3} g'\not{B})d_L + \bar{d}_R(\frac{1}{3} g'\not{B})d_R \\ &\quad -\bar{u}_L(\frac{1}{\sqrt{2}} g\not{W}^+)d_L - \bar{d}_L(\frac{1}{\sqrt{2}} g\not{W}^-)u_L, && (7) \end{aligned}$$

$$\begin{aligned} \mathcal{L}_f^{lept} &= \bar{\nu}_L i\not{\partial}\nu_L + \bar{\nu}_R i\not{\partial}\nu_R + \bar{e}_L i\not{\partial} e_L + \bar{e}_R i\not{\partial} e_R \\ &\quad -\bar{\nu}_L(\frac{1}{2} g\not{W}^3 - \frac{1}{2} g'\not{B})\nu_L \\ &\quad +\bar{e}_L(\frac{1}{2} g\not{W}^3 + \frac{1}{2} g'\not{B})e_L + \bar{e}_R(g'\not{B})e_R \\ &\quad -\bar{\nu}_L(\frac{1}{\sqrt{2}} g\not{W}^+)e_L - \bar{e}_L(\frac{1}{\sqrt{2}} g\not{W}^-)\nu_L && (8) \end{aligned}$$