fields\ groups	$\mathrm{SU}(3)_c$	$\mathrm{SU}(2)_L$	$\mathrm{U}(1)_Y$	$\mathrm{U}(1)_{EM}$
$\chi_L \equiv \begin{pmatrix} \nu_L \\ e_L \end{pmatrix}$	1	2	-1	$\begin{pmatrix} 0 \\ -1 \end{pmatrix}$
e_R	1	1	-2	-1
$Q_L = \begin{pmatrix} U_L \\ D_L \end{pmatrix}$	3	2	$+1/3$	$\begin{pmatrix} +2/3 \\ -1/3 \end{pmatrix}$
U_R	3	1	$+4/3$	$+2/3$
D_R	3	1	-2/3	-1/3
$\Phi \equiv \frac{1}{\sqrt{2}} \begin{pmatrix} 0 \\ v+H \end{pmatrix}$	1	2	1	$\begin{pmatrix} (1) \\ 0 \end{pmatrix}$

fields\ groups	$\mathrm{SU}(3)_c$	$\mathrm{SU}(2)_L$	$\mathrm{U}(1)_Y$	$\mathrm{U}(1)_{EM}$
$\chi_L \equiv \begin{pmatrix}\nu_L \\ e_L\end{pmatrix}$	1	2	-1	$\begin{pmatrix}0 \\ -1\end{pmatrix}$
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$\Phi \equiv \frac{1}{\sqrt{2}}\begin{pmatrix}0 \\ v+H\end{pmatrix}$	1	2	1	$\begin{pmatrix}(1) \\ 0\end{pmatrix}$

$$
\begin{aligned}
\mathcal{L} = & -\frac{1}{2}\,\mathrm{Tr}\, G_{\mu\nu} G_{\mu\nu} - \frac{1}{2}\,\mathrm{Tr}\, W_{\mu\nu} W_{\mu\nu} - \frac{1}{2}\,\mathrm{Tr}\, B_{\mu\nu} B_{\mu\nu} \\
& + \sum_{\psi=\chi_L, e_R, Q_L, U_R, D_R} i\bar{\psi}\gamma^\mu D_\mu \psi \\
& + \sum_{f,g} \left[-G_e^{fg}\, \bar{\chi}_L^f \Phi e_R^g - G_D^{fg}\, \bar{Q}_L^f \Phi D_R^g - G_U^{fg}\, \bar{Q}_L^f \Phi^c U_R^g \right] \\
& + (D_\mu \Phi)^\dagger D_\mu \Phi - \lambda \left(\Phi^\dagger \Phi - \frac{v^2}{2} \right)^2 .
\end{aligned}
$$

$$\mathcal{L} = \mathcal{L}_{\text{QCD}} + \mathcal{L}_{\text{lept}} + \mathcal{L}_{\text{f,EM}} + \mathcal{L}_{\text{f,weak}} + \mathcal{L}_Y + \mathcal{L}_V + \mathcal{L}_H + \mathcal{L}_{VH}.$$

$$\mathcal{L}_{\text{QCD}} = -\frac{1}{4} G^a_{\mu\nu} G^a_{\mu\nu} + \sum_{\text{quarks}} \bar{q}(i\gamma^\mu \partial_\mu - m_q - g_s \frac{\lambda^a}{2} \gamma^\mu G^a_\mu) q,$$

$$\mathcal{L}_{\text{lept}} = \sum_{g=e,\mu,\tau} \bar{e}_g (i\gamma^\mu \partial_\mu - m_{e_g}) e_g + \sum_g \bar{\nu}_g i\gamma^\mu \partial_\mu P_L \nu_g,$$

$$\mathcal{L}_{\text{f,EM}} = eA_\mu \sum_f Q_f \bar{f} \gamma^\mu f,$$

$$\mathcal{L}_{\text{weak}} = \frac{g}{2\sqrt{2}} W_\mu \sum_g \bar{\nu}_g \gamma^\mu (1-\gamma^5) e_g + \text{h.c.}$$
$$+ \frac{g}{2\sqrt{2}} W_\mu \sum_{f,g} \bar{u}_f \gamma^\mu (1-\gamma^5) V_{fg} d_g + \text{h.c.}$$
$$+ \frac{g}{2\cos\theta_W} Z_\mu \sum_{fermions} \bar{f} \gamma^\mu (T_3^f (1-\gamma^5) - 2Q_f \sin^2\theta_W) f,$$

$$\mathcal{L}_Y = \sum_{\text{fermions}} \frac{m_f}{v} \bar{f} f \cdot H.$$

$$\mathcal{L}_V = -\frac{1}{4}(F_{\mu\nu})^2 - \frac{1}{4}(Z_{\mu\nu})^2 + \frac{m_Z^2}{2} Z_\mu Z_\mu$$
$$- \frac{1}{2} W^-_{\mu\nu} W^+_{\mu\nu} + m_W^2 W^-_\mu W^+_\mu + \frac{g^2}{4}(W^+_\mu W^-_\nu - W^+_\nu W^-_\mu)^2$$
$$- \frac{ig}{2}(F^{\mu\nu} \sin\theta_W + Z^{\mu\nu} \cos\theta_W)(W^-_\mu W^+_\nu - W^+_\mu W^-_\nu),$$

$$\mathcal{L}_{HV} = \frac{g^4}{4} vHW^-_\mu W^+_\mu$$
$$+ \frac{g^2 + g'^2}{4} vHZ_\mu Z_\mu$$
$$+ \frac{g^2}{4} H^2 |W^-_\mu|^2$$
$$+ \frac{g^2 + g'^2}{8} H^2 Z_\mu Z_\mu.$$

$$W^-_{\mu\nu} \equiv (\partial_\mu - ieA_\mu - ig\cos\theta_W Z_\mu) W^-_\nu - (\mu \leftrightarrow \nu).$$

$$\mathcal{L}_H = \frac{1}{2}(\partial_\mu H)^2 - \frac{m_H^2}{2} H^2 - \lambda v H^3 - \frac{\lambda}{4} H^4.$$