Electrophobic with 3 Higgs Doublets

H_1, H_2, H_3 → leptons

1) Q_Y - a decoupling condition

$\not{*}$ $\underline{v_1^2 \chi_1 + v_2^2 \chi_2} + v_3^2 \chi_3 = 0$

2) II Nucleophobic condition

$\not{*}$ $\frac{\chi_1 + \chi_2}{\chi_1 - \chi_2} \simeq 1/3 \equiv f_{ud}$

3) Breaking $U(1)_{H_1} \times U(1)_{H_2} \times U(1)_{H_3} \times U(1)_\Phi \to U(1)_Y \times U(1)_{EM}$ Explic.

$H_3^+ H_1 \phi^m + H_3^+ H_2 \phi^n$

$\phi^{-|n|} = (\phi^*)^{|n|}$

$H_1^+ H_2 \phi^m + H_1^+ H_3 \phi^n$

$m, n = \pm 1, \pm 2$

$\not{*} \Rightarrow \begin{cases} -\chi_3 + \chi_1 + m = 0 \\ -\chi_3 + \chi_2 + n = 0 \end{cases}$

$\chi_1 = \dots$

$\chi_2 = \dots$

$f_{ud} = \dfrac{m+n-2\chi_3}{m-n}$

$\dfrac{v_2}{v_1} = \dots$

→ $\chi_3 = 0$: decoupling condition

the important relation

Values of $m, n = \pm 1, \pm 2$ can only produce:

$f_{ud} = 1/3, 0, 3$

physical result

$m_U = m_D$