4/26/2010 14:39

$$\mathcal{L} = \bar\Psi i\gamma^\mu \partial_\mu \Psi - g\bar\Psi\gamma^\mu A_\mu \Psi - m\bar\Psi\Psi$$

$$\partial_\alpha\left(\frac{\partial\mathcal{L}}{\partial(\partial_\alpha\Psi)}\right) = \frac{\partial\mathcal{L}}{\partial\Psi}$$

$$\partial_\alpha\left(\bar\Psi i\gamma^\mu \delta_{\alpha\mu}\right) = -g\bar\Psi\gamma^\mu A_\mu - m\bar\Psi$$

$$\partial_\alpha\left(\bar\Psi i\gamma^\alpha\right)$$

$$(\partial_\mu\bar\Psi)(i\gamma^\mu) = -g\bar\Psi\gamma^\mu A_\mu - m\bar\Psi$$

$$0 = -(\partial_\mu\bar\Psi)(i\gamma^\mu) - g\bar\Psi\gamma^\mu A_\mu - m\bar\Psi$$

4/26/2010 14:52

$$-i\gamma^{\mu T}(\partial_\mu \bar{\Psi})^T - g\gamma^{\mu T} A_\mu \bar{\Psi}^T - m\bar{\Psi}^T = 0$$

$$-i C\gamma^{\mu T}(\partial_\mu \bar{\Psi})^T - g C\gamma^{\mu T} A_\mu \bar{\Psi}^T - m C\bar{\Psi}^T = 0$$

$$i\gamma^\mu C(\partial_\mu \bar{\Psi})^T + g\gamma^\mu A_\mu C\bar{\Psi}^T - m C\bar{\Psi}^T = 0$$

$$\boxed{C\gamma^{\mu T} = -\gamma^\mu C} \qquad \boxed{C\gamma^{\mu T} = -\gamma^\mu C}$$

$$\boxed{\psi^c = C\bar{\Psi}^T}$$

$\rightarrow$ If C exists, ✓

4/26/2010 14:58

$$\underline{\underline{\psi^c}} = \underline{\underline{C\bar{\psi}^T}} = C(\psi^\dagger\gamma^0)^T$$

$$= \underline{\underline{C\gamma^{0T}\psi^*}}$$

$$C\gamma^{\mu T} = -\gamma^\mu C$$

$$= \underline{\underline{-\gamma^0 C\psi^*}}$$

$$\cancel{\boxed{\psi^c = C\gamma^0\psi^*}}$$

$$\overline{\psi^c} = \cancel{(C\bar{\psi}^T)^\dagger\gamma^0}$$

$$= (-\gamma^0 C\psi^*)^\dagger \underline{\gamma^0} = -\psi^T C^\dagger\gamma^0\gamma^0$$

$$= -\psi^T C^\dagger$$

4/26/2010 15:03

$$\psi = (\psi^c)^c = (-\gamma^0 C \psi^*)^c$$

$$= -\gamma^0 C (-) \gamma^{0*} C^* \psi$$

$$= \gamma^0 \underbrace{C \gamma^{0T}} C^* \psi$$

$$= -\underline{\underline{\gamma^0 \gamma^0}} C C^* \psi$$

$$= - C C^* \psi \qquad \boxed{C C^* = -1}$$

4/26/2010 15:23

$$\overline{(\nu_L{}^c)} \quad \nu_L$$

$$Q = \frac{Y}{2} + T_3$$

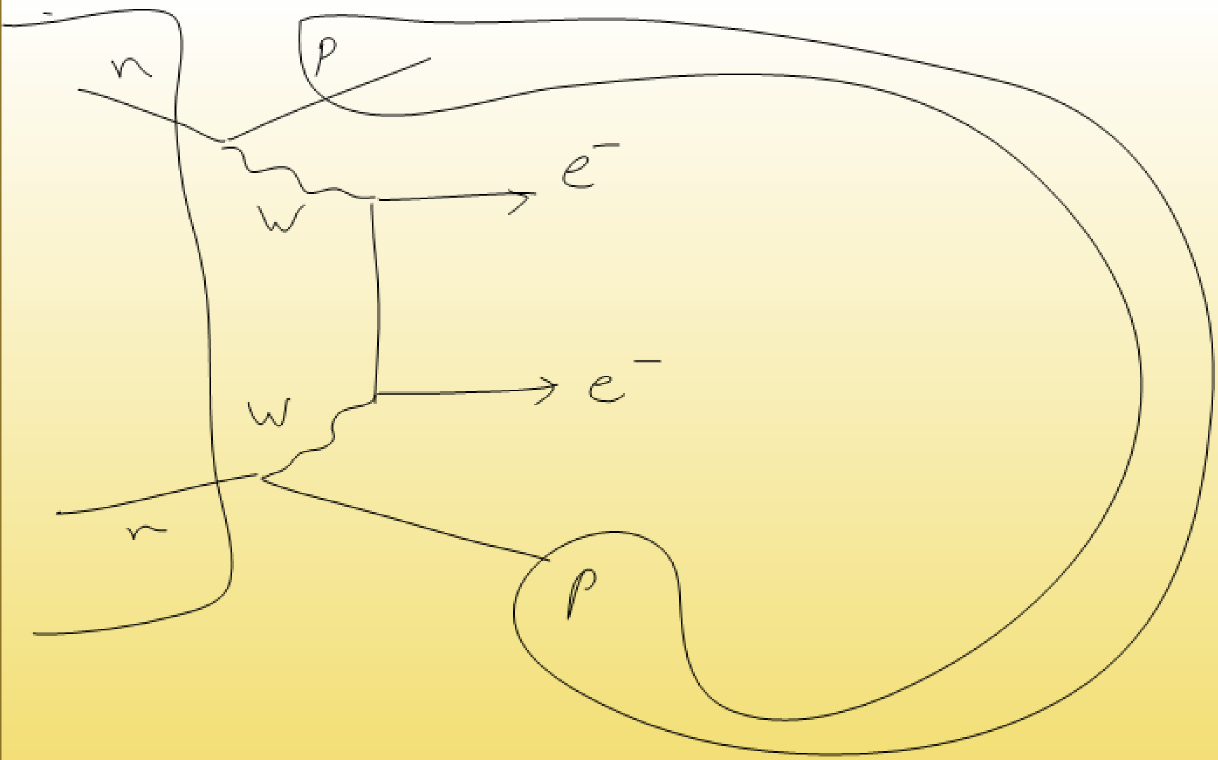
$$Y \qquad -1 \quad -1$$

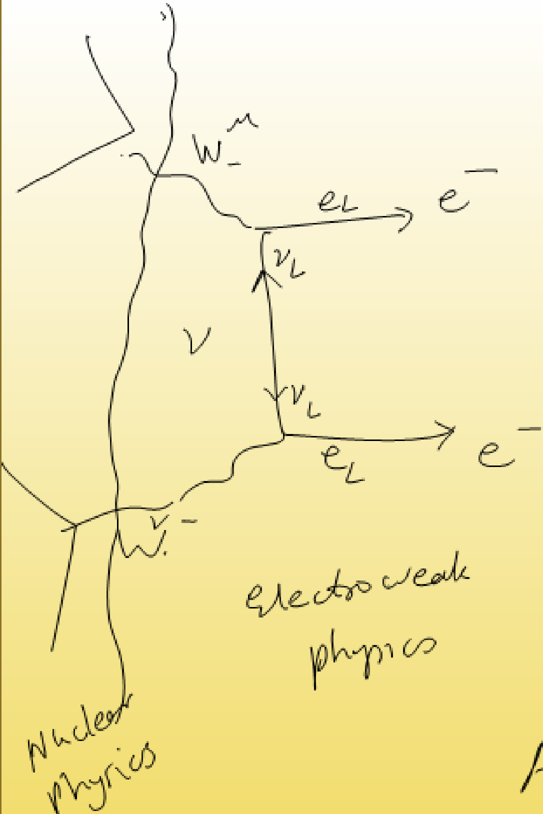
$$\ominus = \qquad + \frac{1}{2}$$

$$\rightarrow 2$$

$$Y = -1$$

4/26/2010 15:40





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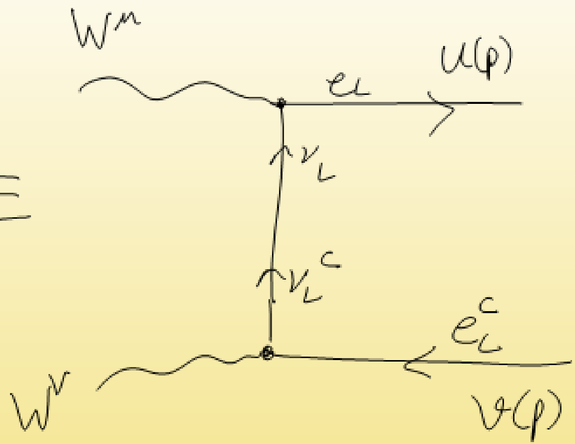


$$\cancel{e_L \gamma^\nu \overline{\nu_L^c}\, \nu_L \gamma^\mu \overline{e_L}}$$

$$A \sim \overline{e_L^c}\, \gamma^\nu \nu_L^c\, \overline{\nu_L}\, \gamma^\mu e_L$$

4/26/2010 15:46

$$\overline{e_L^c}\,\gamma^\nu\,\underbrace{\nu_L^c\,\overline{\nu_L}}\,\gamma^\mu\,e_L$$

$$\cancel{\mathcal{L} = \frac{1}{2}\bar{\nu}\left(i\gamma^\mu\partial_\mu - m_L\right)\nu_L}$$

$$\mathcal{L} = \frac{1}{2}\bar{\nu}\left(i\gamma^\mu\partial_\mu - m_L\right)\nu$$

$$\nu = \nu_L + \nu_L^c$$

$$\overline{e_L^c}\,\gamma^\nu\,\frac{1}{\not{p} - m_L}\,\gamma^\mu\,e_L$$

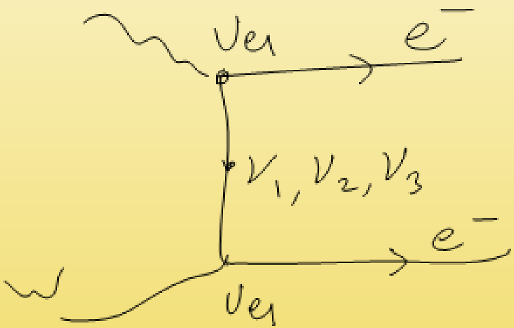
$$\overline{e_L^c}\,\gamma^\nu\,\frac{(\not{p} + m_L)\,\gamma^\mu}{p^2 - m_L^2}\,e_L$$

$$0$$

$$\frac{\overline{e_L^c}\,\gamma^\nu\,\not{p}\,\gamma^\mu\,e_L}{p^2}$$

$$\frac{\overline{e_L^c}\,\gamma^\nu\,m_L\,\gamma^\mu\,e_L}{p^2}$$

$$A \sim \underline{\underline{m_L}} \; \boxed{\frac{\bar{e}_L^{c}\gamma^\mu\gamma^\nu e_L}{p^2}\,\langle Y|H|X\rangle}$$



$$A \propto m_\nu$$

$$\sim m_1 V_{e1}^2 + m_2 V_{e2}^2 + m_3 V_{e3}^2$$