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$$\bar{\nu}_e \rightsquigarrow \bar{\nu}_e, \bar{\nu}_\mu, \bar{\nu}_\tau$$

$$c_{12}^2 \quad \bar{\nu}_1 \rightsquigarrow \bar{\nu}_1 \quad c_{12}^2$$

$$s_{12}^2 \quad \bar{\nu}_2 \rightsquigarrow \bar{\nu}_2 \quad s_{12}^2$$

$$0 \quad \bar{\nu}_3 \rightsquigarrow \bar{\nu}_3 \quad 0$$

$$\bar{\nu}_e \to c_{12}^2 \cdot c_{12}^2 + s_{12}^2 \cdot s_{12}^2 \to \boxed{c_{12}^4 + s_{12}^4}$$

$$\cancel{\bar{\nu}_\mu \to c_{12}^2 \cdot U_{\mu 1}^2 +}$$

$$\bar{\nu}_\mu \longrightarrow c_{12}^2\, U_{\mu 1}^2 + s_{12}^2\, U_{\mu 2}^2$$

$$c_{12}^2\, s_{12}^2\, c_{23}^2 + s_{12}^2\, c_{12}^2\, c_{23}^2$$

$$\boxed{2\, c_{23}^2\, s_{12}^2\, c_{12}^2}$$

$$\nu_\tau \longrightarrow c_{12}^2\, U_{\tau 1}^2 + s_{12}^2\, U_{\tau 2}^2$$

$$c_{12}^2\, s_{12}^2\, s_{23}^2 + s_{12}^2\, c_{12}^2\, s_{23}^2$$

$$\boxed{2\, s_{23}^2\, s_{12}^2\, c_{12}^2}$$

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$$P_{\bar{\nu}_e \to \bar{\nu}_e} = 1 - \sum_{ij} \square_{eeij} \sin^2(\Delta)$$

$$1 - \frac{1}{2}\left(\square_{ee12} + \cancel{\square_{ee13}} + \cancel{\square_{ee23}}\right)$$

$$1 - \frac{1}{2}\sin^2 2\theta_{12}$$

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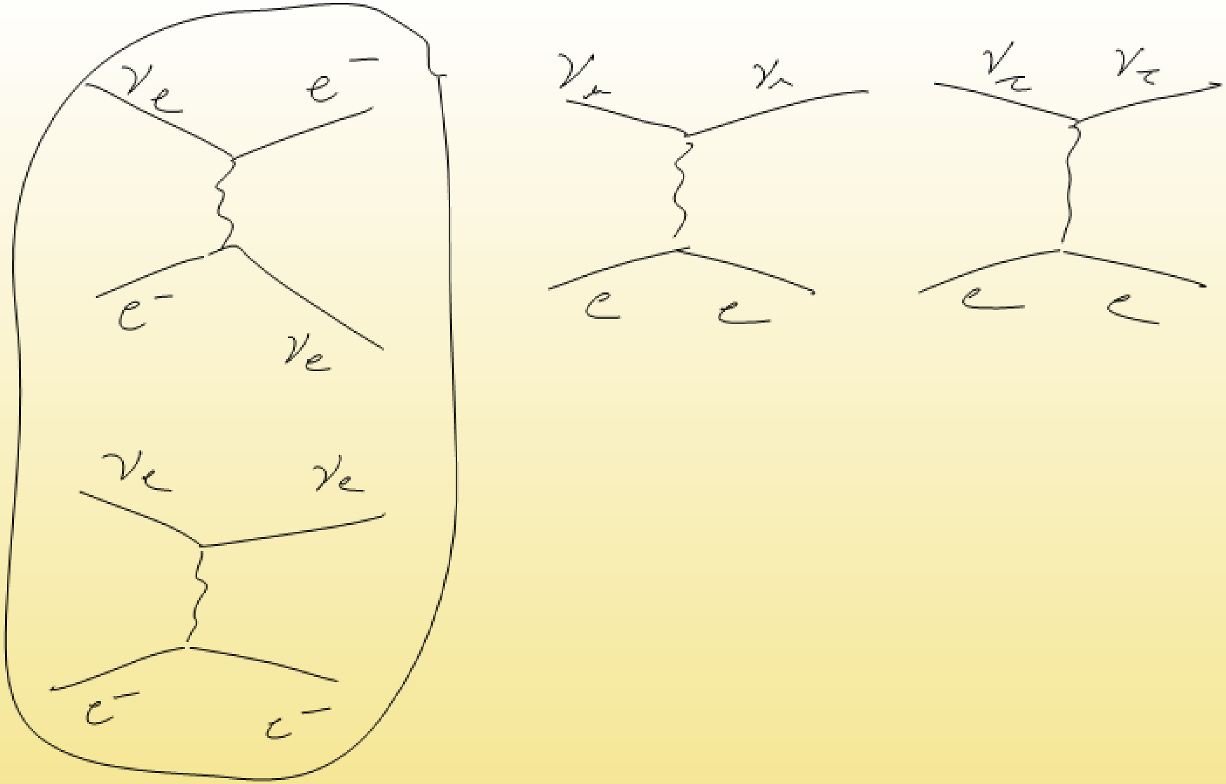

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No conversion: $N_{exp} = \Phi_0 \sigma(\nu_e e^-)$

With conversion.

$$N_{obs} = \Phi_0 \sigma(\nu_e e^-) \underbrace{\sin^2\theta}_{P_{ee}} + \Phi_0 \sigma(\nu_\mu e^-) \underbrace{\cos^2\theta}_{(1-P_{ee})}$$

$$\frac{N_{obs}}{N_{exp}} = \frac{\sin^2\theta\, \sigma(\nu_e e^-) + \cos^2\theta\, \sigma(\nu_\mu e^-)}{\sigma(\nu_e e^-)}$$

$$= \frac{\sin^2\theta \;\; 9.5 + \cos^2\theta \;\; 1.6}{9.5} = 0.47$$

$$\approx \sin^2\theta + \frac{1}{6}\cos^2\theta = 0.47$$

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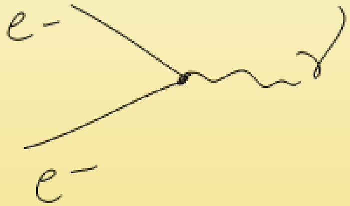
$$A = \cos\theta_w \, B + \sin\theta_w \, W_3 \qquad \tan\theta_w = \frac{g'}{g}$$

$$= \frac{g}{\sqrt{g^2+g'^2}} B + \frac{g'}{\sqrt{g+g'^2}} W_3$$



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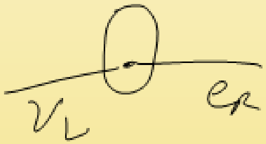
$$\mathcal{L} \to \bar{l}\,\phi\, e_R$$

$$\begin{pmatrix} \bar{\nu}_L & \bar{e}_L \end{pmatrix} \begin{pmatrix} \varphi^+ \\ \varphi^0 \end{pmatrix} e_R$$

$$\bar{\nu}_L\, \varphi^+ e_R \;+\; \bar{e}_L\, \varphi^0 e_R$$



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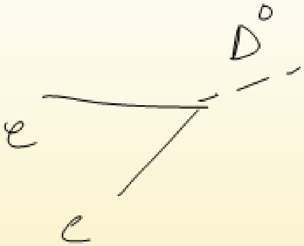
$$|m_{\beta\beta}|^2 = |c_{12}^2 c_{13}^2 e^{2i\varphi_1} m_1 + s_{12}^2 c_{13}^2 e^{2i\varphi_2} m_2 + s_{13}^2 e^{-2i\delta} m_3|^2$$

$$(\bar{\nu}_L\ \ \bar{e}_L)\begin{pmatrix}\Delta^{-}/\sqrt{2} & \Delta^{0}\\ \Delta^{--} & -\Delta^{-}/\sqrt{2}\end{pmatrix}\begin{pmatrix}e_R^c\\ \nu_L^c\end{pmatrix}$$

$\uparrow$

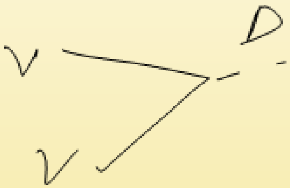
$\tau\cdot\Delta$

$\mathcal{L}$



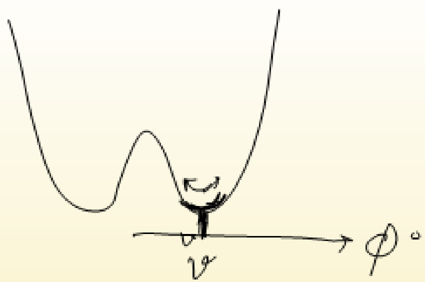
$$\tau^+\boxed{\Delta_+}+\tau^0\boxed{\Delta_0}+\tau^-\boxed{\Delta_-}$$

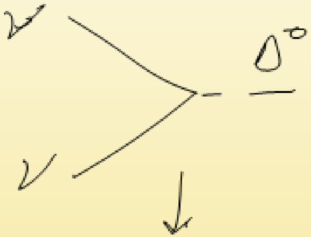
$$\Delta^0 \qquad \Delta^- \qquad \Delta^{--}$$



$$\bar{\nu}_L\,\frac{\Delta^-}{\sqrt{2}}\,e_L^c$$

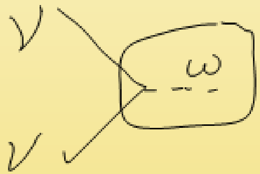
$$\phi \longrightarrow \begin{pmatrix} 0 \\ \underline{\underline{v}} + \underline{h} \end{pmatrix}$$

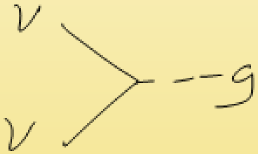




$$\Delta^0 = \langle \Delta^0 \rangle + g$$

$$= \omega + g$$





$m_\nu \sim \omega$

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$$\bar{e}_L \Phi e_R$$

$$\boxed{\bar{e}_L \varphi^0 e_R}$$

$$\frac{1}{\sqrt{2}} \quad \lambda \bar{e}_L v e_R + \bar{e}_L h e_R$$

$\downarrow$

$$\underbrace{\lambda v}\, \bar{e}_L e_R$$

$$\Delta = \begin{pmatrix} \Delta^0 \\ \Delta^- \\ \Delta^{--} \end{pmatrix} \qquad I = 1$$

$$Y = -2$$

$$\bar{\Delta}\, \gamma^\mu \left(-\frac{g'}{2}\right) B_\mu\, Y\, \Delta$$

$$\underline{-2}\ \bar{\Delta}\, \gamma^\mu\, \underline{\left(-\frac{g'}{2}\right) B_\mu}\, \Delta$$