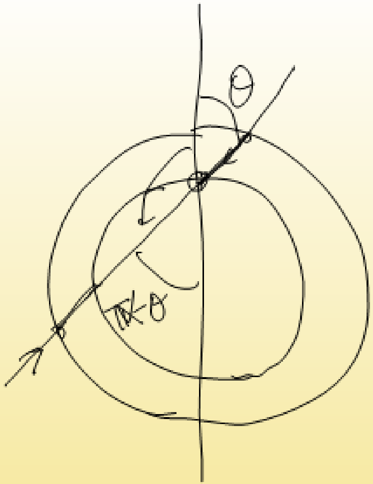
2/16/2010 14:39



$K \to \mu\, \nu_\mu$

$\quad \llcorner\, e\, \nu_e\, \nu_\mu$

double ratio

$$= \frac{(\nu_\mu / \nu_e)\ \text{detected}}{(\nu_\mu / \nu_e)\ \text{expected}} \qquad \frac{dN}{d\log E} = \frac{E}{\cancel{E}}\frac{dN}{dE}$$

$$\nu_\alpha = \cos\theta\ \nu_1 + \sin\theta\ \nu_2$$

$$|\nu_\alpha(t)\rangle = \cos\theta \cdot |\nu_1(t)\rangle + \sin\theta\, |\nu_2(t)\rangle$$

$$= \cos\theta\ |\nu_1(0)\rangle e^{-ipt}\, e^{-\frac{im_1^2}{2E}t}$$

$$+ \sin\theta\ |\nu_2(0)\rangle e^{-ipt}\, e^{-\frac{im_2^2}{2E}t}$$

$$\left|\langle \nu_\alpha(0)|\nu_\alpha(t)\rangle\right|^2 \leftarrow P_{\nu_\alpha\to\nu_\alpha}$$

$$\nu_\alpha(0) = \cos\theta\ |\nu_1(0)\rangle + \sin\theta\ |\nu_2(0)\rangle$$

$$\langle \nu_\alpha(0)|\nu_\alpha(t)\rangle = \cos^2\theta\ e^{-ipt}\, e^{-\frac{im_1^2}{2E}t} + \sin^2\theta\ e^{-ipt}\, e^{-\frac{im_2^2}{2E}t}$$

$$|\langle \quad | \quad \rangle|^2 = \cos^4\theta + \sin^4\theta + 2\cos^2\theta\,\sin^2\theta\,\cos\left(\frac{(m_2^2-m_1^2)}{2E}t\right)$$

$$= \cos^4\theta + \sin^4\theta + 2\sin^2\theta\cos^2\theta\,\cos\left(\frac{\Delta m^2}{2E}t\right)$$

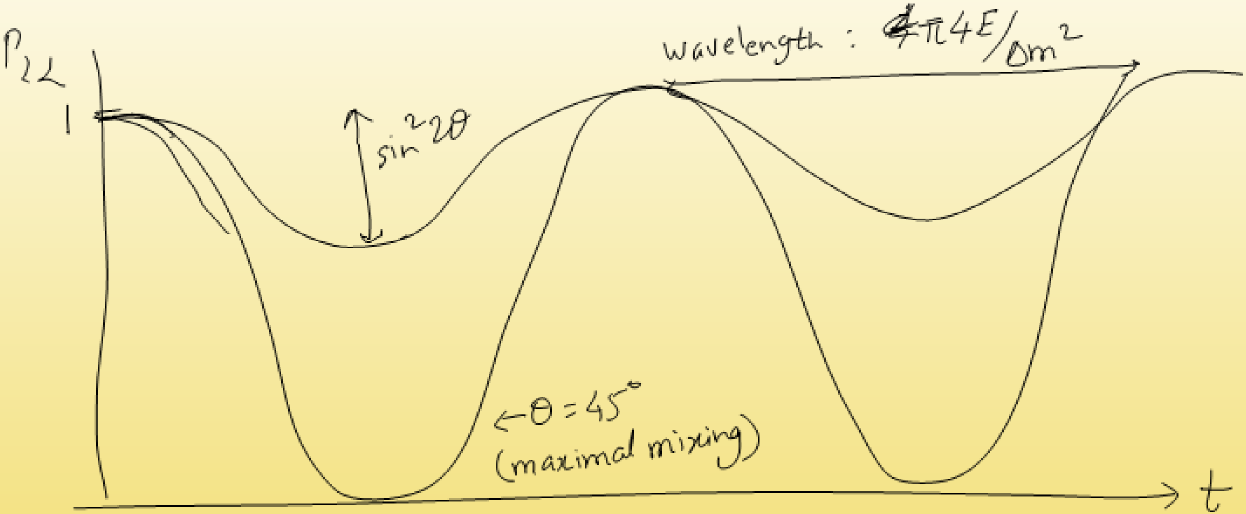
$$= \underbrace{\cos^4\theta + \sin^4\theta + 2\sin^2\theta\cos^2\theta} - 2\sin^2\theta\cos^2\theta + 2\sin^2\theta\cos^2\theta\cos\left(\frac{\Delta m^2 t}{2E}\right)$$

$$= 1 - \frac{\sin^2 2\theta}{2}\left[1 - \cos\left(\frac{\Delta m^2 t}{2E}\right)\right]$$

$$\boxed{P_{\nu_\alpha \to \nu_\alpha} = 1 - \sin^2 2\theta \cdot \sin^2\left(\frac{\Delta m^2 t}{4E}\right)}$$

Survival probability

$$P_{\alpha\alpha} = 1 - \sin^2 2\theta \, \sin^2\left(\frac{\Delta m^2 t}{4E}\right)$$



$$\text{expt} \longrightarrow \Delta m^2, \ \sin^2 2\theta$$

2/16/2010 15:39

$\cos\theta = -1$, low E

$$P_{\alpha\alpha} = 1 - \sin^2 2\theta \sin^2\left(\frac{\Delta m^2 t}{4E}\right)$$

$$\downarrow$$

$$1 - \frac{1}{2}\sin^2 2\theta \sim \frac{1}{2} \text{ (observation)}$$