NEUTRINO OSCILLATIONS

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(assumption: 2 state oscillations) Eigen state of neutrino:

$$\nu_1 = \cos\theta\nu_\mu - \sin\theta\nu_e; \nu_2 = \sin\theta\nu_\mu + \cos\theta\nu_e \tag{1}$$

As usual, by solving the schrodinger equation for two state system, we get

$$\nu_1(t) = -\sin\theta e^{-iE_1t/\hbar}; \nu_2 = \cos\theta e^{-iE_2t/\hbar} \tag{2}$$

Solving for ν_μ

$$\nu_\mu(t) = \sin\theta\cos\theta(-e^{-iE_1t/\hbar} + e^{-iE_2t/\hbar}) \tag{3}$$

$$P_{\nu_e\to\nu_\mu} = \left[\sin(2\theta)\sin(\frac{E_2 - E_1}{2\hbar}t)\right]^2 \tag{4}$$

which is approximately $\left[\sin(2\theta)\sin[\frac{(m_2^2-m_1^2)c^3}{4\hbar E}z]\right]^2$