Neutrino Oscillations in Vacuum and Matter [1]

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Notes for neutrino oscillations in vacuum and dense matter.

Vacuum Oscillations

Schrodinger equation is

$$i\partial_t \Psi = \mathbf{H}\Psi, \tag{1}$$

where for relativistic neutrinos, the energy is

$$\begin{aligned}\mathbf{H} &= \sqrt{p^2 + m^2} \\ &= p\sqrt{1 + \frac{m^2}{p^2}} \\ &\approx p(1 + \frac{1}{2}\frac{m^2}{p^2}).\end{aligned}$$

Oscillations in Dense Medium