

Homework Set #12

Due Date: Friday May 1st

1) Neutrino Oscillations

(5 points)

In the two flavour approximation, work out the probability for a ν_e to be detected as a ν_μ as a function of mixing angle, mass difference, distance traveled and Energy.

Sketch the probability as a function of L/E .

2) Cosmic Rays

(5 points)

What ratio of ν_e and ν_μ do you expect in cosmic rays at low energies ?

(Treat cosmic rays as protons which produce pions.)

What can cause this ratio to change at higher energies ?

3) SNO

(5 points)

SNO measured the ν flux in three different ways. Draw the corresponding Feynman diagrams and indicate if you would expect a difference in cross section between the different ν flavours.

4) ν beams

(5 points)

- How could you make a beam of ν s ?
- What ν flavours would be produced ?
- Would you expect this to make more ν or anti- ν ?
- How could you enhance the ν fraction ?
- How about the anti- ν fraction ?