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)*

a) How could you make a beam of νs ?

b) What ν flavours would be produced ?

c) Would you expect this to make more ν or anti-ν ?

d) How could you enhance the ν fraction ?

e) How about the anti-ν fraction ?