PHYS4801 - Seminar I
Outline and Abstract

Group no.: 16
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**Topic: Neutrino Oscillations**

<u>Outline</u>

1. Background
    a. What are neutrinos
    b. Solar neutrino problem
    c. Neutrino oscillation
        i. What is it
            1. neutrino mixing matrix, flavor & mass eigenstate
        ii. Why do they oscillate?
            1. superposition of mass eigenstate changes as the the neutrino propagate
        iii. Implications and importance
            1. 2015 Nobel Prize
            2. Neutrino mass (Oscillation->mass difference non-zero->neutrinos have masses)

2. Measurement of oscillation parameters θ13 and Δm23 (main theme)
    a. Oscillation probability
    b. Mixing angle and mass difference

3. Oscillation experiments
    a. Daya Bay experiment
        i. Methods
            1. Baseline and energy
            2. Final states from neutrino interaction
            3. Working mechanisms (e.g. Liquid scintillator technique)
        ii. Solutions
            1. Antineutrino disappearance
            2. Distortion of energy spectrum
    b. T2K experiment
        i. Methods
            1. Baseline and energy
            2. Final states from neutrino interaction
            3. Working mechanisms
        ii. Solutions
            1. Allowed region of oscillation parameters and energy spectrum

4. Discussions of Results
    a. Values of θ13 and Δm23 from experimental data
    b. Ongoing and future experiments

Abstract

Neutrino oscillation is the phenomenon that the flavor of a neutrino changes the particle propagates in space, implying that the neutrino has non-zero mass. We are interested in measuring the oscillation parameters, θ13 and Δm23, as they respectively give information about the mixing between flavour and mass eigenstates and the mass hierarchy. We begin with describing how the parameters can be observed from oscillation probabilities. The Daya Bay and T2K experiments are sensitive in probing these parameters. Their detection methods and the acquired data are discussed, followed by presenting the determined values of the 2 parameters.