Measuring charged current neutrino interactions in the Electromagnetic Calorimeters in near detector of T2K

Dominic Brailsford
TODO

A thesis submitted to Imperial College London
for the degree of Doctor of Philosophy

Abstract

To write

Declaration

This dissertation is the result of my own work, except where explicit reference is made to the work of others, and has not been submitted for another qualification to this or any other university. This dissertation does not exceed the word limit for the respective Degree Committee.

Dominic Brailsford

Acknowledgements

Something about my supervisor ...

Preface

This thesis describes my analysis of the ν_μ charged-current cross-section on lead using the T2K near detector electromagnetic calorimeters.

Contents

"These chickens jackin' my style. "

— Fergie

Chapter 1

Introduction

The field of neutrino physics is currently undergoing a revolution. With its tenuous postulation [1] acting as a future omen, the neutrino's mark on history would not become apparent from its discovery [2–4], but rather from a spate of surprising discoveries at the end of the 20th century [5–7] which conclusively proved that the Standard Model, while very successful, was incomplete. This revelation was experimental proof of Maki, Nagakawa and Sakata's extension [8] to Pontecorvo's theory of neutrino oscillation [9] with the inclusion of the Mikheyev-Smirnov-Wolfenstein (MSW) effect [10, 11]. The findings were groundbreaking as the underlying theory requires massive neutrinos, which is in direct contradiction to the Standard Model. The, now, standard theory of neutrino oscillation defines three neutrino flavours and three neutrino masses. However, the map between flavour and mass is not one-to-one, but rather a rotation of mass space onto flavour space as

$$\begin{pmatrix} \nu_e \\ \nu_m u \\ \nu_\tau \end{pmatrix} \tag{1.1}$$

1.1 The state of the field

Neutrino oscillations are really kool

Bibliography

[1] W. Pauli, Open letter to the Gauverein meeting in Tubingen, 1930.

[2] C. L. Cowan, F. Reines, F. B. Harrison, H. W. Kruse, and A. D. McGuire, Science **124**, 103 (1956).

[3] G. Danby *et al.*, Phys. Rev. Lett. **9**, 36 (1962).

[4] K. Kodama *et al.*, Physics Letters B **504**, 218 (2001).

[5] Y. Fukuda *et al.*, Phys. Rev. Lett. **81**, 1562 (1998).

[6] Q. R. Ahmad *et al.*, Phys. Rev. Lett. **87**, 071301 (2001).

[7] K. Eguchi *et al.*, Phys. Rev. Lett. **90**, 021802 (2003).

[8] Z. Maki, M. Nakagawa, and S. Sakata, Progress of Theoretical Physics **28**, 870 (1962).

[9] B. Pontecorvo, JETP Lett. **33**, 549 (1957).

[10] L. Wolfenstein, Phys. Rev. D **17**, 2369 (1978).

[11] S. Mikheev and A. Y. Smirnov, Sov.J.Nucl.Phys. **42**, 913 (1985).

List of Figures

List of Tables