

A Search for Sterile Neutrinos at the NO ν A Far Detector

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ABSTRACT

We measured things. And searched for other things. Here is what we found, please let me graduate.

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THIS IS THE DEDICATION.

Acknowledgments

These people were cool.

1

A Brief History of Neutrinos

1.1 INTRODUCTION

The neutrino was first postulated by Wolfgang Pauli as a possible explanation for the continuous spectrum of electrons emitted from nuclear β decay¹. This decay was originally thought to be the emission of an electron from an atom, resulting in a different nucleus, via the process,

$$N \rightarrow N' + e \tag{1.1}$$

where N and N' are the parent and daughter nuclei, respectively.

Three years later,

1.2 FIRST DETECTION OF NEUTRINOS

1.3 FIRST OF EVIDENCE OF OSCILLATIONS

1.4 POSSIBLE EVIDENCE OF STERILE NEUTRINOS

2

Theory of Neutrino Oscillations

2.1 STANDARD 3-FLAVOR OSCILLATIONS

2.2 MATTER EFFECTS

2.3 STERILE NEUTRINOS

2.4 CURRENT MEASUREMENTS

3

The NO ν A Experiment

3.1 INTRODUCTION

3.2 THE NUMI BEAM

3.3 THE NO ν A DETECTORS

3.3.1 NEAR DETECTOR

3.3.2 FAR DETECTOR

4

Experiment Simulation

4.1 INTRODUCTION

4.2 FLUX SIMULATION

4.3 DETECTOR SIMULATION

5

Event Reconstruction

5.1 RECONSTRUCTION CHAIN

5.2 CALIBRATION

6

Neutral Current Event Selection

6.1 PRESELECTION

6.2 CVN BASED SELECTION

6.3 STANDARD PID CROSS CHECK

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Neutral Current Disappearance Analysis

7.1 THE ANALYSIS CHAIN

7.2 NEAR DETECTOR DECOMPOSITION

7.3 EXTRAPOLATION

7.4 FAR DETECTOR PREDICTION

8

Analysis Results and Systematic Errors

8.1 FITTING METHOD

8.2 SYSTEMATIC ERRORS

8.3 RESULTS

9

Conclusions and Future Improvements

9.1 CONCLUSIONS

The results of this analysis are consistent with no sterile neutrinos.

9.2 FUTURE IMPROVEMENTS

References

- [1] Pauli, W. (1930). Letter to a physicists' gathering at tubingen.



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