

Search for Neutrino Transients Using IceCube and DeepCore

A Thesis
Presented to
The Academic Faculty

by

Jacob D. Daughhetee

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

School of Physics
Georgia Institute of Technology
August 2014

Search for Neutrino Transients Using IceCube and DeepCore

Approved by:

Professor Pablo Laguna, Committee
Chair

Professor Carol Paty
(Earth and Atmospheric Science)

Professor Ignacio Taboada, Adviser

Professor

Professor Nepomuk Otte

Professor

Date Approved _____

PREFACE

This dissertation is based on data acquired with the IceCube Neutrino Observatory whose maintenance and operation is the result of an immense international collaborative effort. While ... (acknowledge previous work?)

ACKNOWLEDGEMENTS

I want to thank my fellow graduate student office mates (would've gone insane without their distractions).

TABLE OF CONTENTS

DEDICATION	iii
PREFACE	iv
ACKNOWLEDGEMENTS	v
LIST OF TABLES	vii
LIST OF FIGURES	viii
SUMMARY	ix
I INTRODUCTION	1
II DETECTOR	2
III PREVIOUS POINT SOURCE SEARCHES	3
IV DATA ACQUISITION	4
V EVENT SELECTION	5
VI ANALYSIS METHOD	6
VII RESULTS	7
VIII CONCLUSION	9
APPENDIX A — SOME ANCILLARY STUFF	10
INDEX	12
VITA	13

LIST OF TABLES

LIST OF FIGURES

1	A first figure.	7
2	A second figure.	8

SUMMARY

Observations indicate that there is a correlation between long duration gamma-ray bursts (GRBs) and core-collapse supernovae (SNe). The leading model for GRB production assumes that relativistic jets are generated by the core-collapse within the progenitor star. Charged particles undergo Fermi-acceleration within internal shocks of these jets and subsequently give rise to gamma ray emission once the jets breach the surrounding stellar envelope. Very few SNe result in the occurrence of GRBs, however, but it has been suggested that a significant fraction of core-collapse SNe manage to produce mildly relativistic jets. These jets are insufficiently energetic to break through the envelope and are effectively 'choked' resulting in a lack of observed gamma ray emission. In both the failed and successful GRB scenario, neutrino production can occur if protons are accelerated in the internal shocks of these jets. These neutrinos may be detectable by the IceCube neutrino observatory and its low energy extension DeepCore. A dedicated search for temporal and spatial clustering of neutrino events during the 2012 data season aims to reveal the presence of any 'choked' GRB events within 20 Mpc.

CHAPTER I

INTRODUCTION

CHAPTER II

DETECTOR

The IceCube Neutrino Observatory is located at the geographical South Pole deep within the glacial ice of the Antarctic ice sheet. This site allowed for the use of the Amundsen-Scott South Pole station as a staging ground and logistics hub for the construction and continued operation of the detector.

CHAPTER III

PREVIOUS POINT SOURCE SEARCHES

CHAPTER IV

DATA ACQUISITION

CHAPTER V

EVENT SELECTION

CHAPTER VI

ANALYSIS METHOD

CHAPTER VII

RESULTS

Some other research was once performed [1].

Figure 1: A first figure.

Figure 2: A second figure.

CHAPTER VIII

CONCLUSION

APPENDIX A

SOME ANCILLARY STUFF

Ancillary material should be put in appendices, which appear just before the bibliography.

REFERENCES

- [1] JR, N., “My article,” 2006.

INDEX

VITA