

**Meson Spectra from a Dynamical Three-Field Model of
AdS/QCD**

**A THESIS
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA
BY**

Sean Peter Bartz

**IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY**

Joseph I. Kapusta

August, 2014

© Sean Peter Bartz 2014
ALL RIGHTS RESERVED

Acknowledgements

There are many people that have earned my gratitude for their contribution to my time in graduate school.

This research is supported by the Department of Energy Office of Science Graduate Fellowship Program (DOE SCGF), made possible in part by the American Recovery and Reinvestment Act of 2009, administered by ORISE-ORAU under contract no. DE-AC05-06OR23100, by the US Department of Energy (DOE) under Grant No. DE-FG02-87ER40328, and by a Doctoral Dissertation Fellowship from the University of Minnesota.

Dedication

To my parents, Larry and Colleen, my first teachers. To my sister, Haley, my first student. To my wife, Alicia, my greatest support.

Abstract

Gauge/gravity dualities are a tool that allow the analytic analysis of strongly-coupled gauge theories. The Anti-de Sitter Space/Conformal Field Theory conjecture posits a duality between ten-dimensional string theory and a super Yang-Mills theory. A phenomenologically-motivated modification of this correspondence is known as AdS/QCD, a duality between strongly-coupled QCD-like theories and weakly-coupled gravitational theories in an additional dimension. QCD is not scale-invariant, so the dual theory must be modified in the conformal dimension to reflect this.

This thesis examines “soft-wall” models of AdS/QCD, wherein the conformal symmetry is broken by a field known as a dilaton. The dynamics of the dilaton and other background fields are examined, and a potential for these fields is determined. The background fields are numerically derived from this potential and used in the calculation of meson spectra, which match well to experiment.

The work presented here is based upon previously-published work by the author:

Contents

List of Tables

List of Figures

Chapter 1

Introduction

- Chapter 2 briefly presents the history of, and science behind, the subjects presented in this thesis.
- In Chapter 3 the experiment is outlined.
- Chapter 4 describes the simulation process used in the analysis.
- Chapter 5 follows the chain of reconstruction software used to obtain meaningful results from data.
- Chapter 6 hashes out the strategy for analysis and presents the data and simulated sets that will be used in the analysis.
- Chapter 7 demonstrates the implementation of the event selection processes.
- In Chapter 8 those events selected in Chapter 7 are analyzed.
- Chapter 9 presents a final discussion of the analyses presented in the thesis.

Chapter 2

Conclusion and Discussion

Appendix A

Glossary and Acronyms