

A Dissertation

Submitted to the Faculty

of

Purdue University

by

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In Partial Fulfillment of the

Requirements for the Degree

of

Doctor of Philosophy

May 2018

Purdue University

West Lafayette, Indiana

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SYMBOLS

m mass

v velocity

ABBREVIATIONS

LXe Liquid xenon

GXe Gasseous xenon

TPC Time projection chamber

WIMP Weakly interacting massive particle

DM Dark matter

LNGS Laboratori Nazionali del Gran Sasso

ABSTRACT

Masson, Darryl PhD, Purdue University, May 2018. The Search for Dark Matter with XENON1T. Major Professor: Rafael F. Lang.

Dark matter! We still don't know what it is.

1. The Case for Dark Matter

- 1.1 Evidence for Dark Matter
- 1.1.1 Galactic Rotation curves
- 1.1.2 Galaxy cluster dynamics

Bullet cluster

- 1.1.3 Gravitational lensing
- 1.1.4 Structure formation
- 1.1.5 Cosmic Microwave Background (CMB)
- 1.1.6 Big Bang Nucleosynthesis (BBN)
- 1.2 Dark Matter in the universe today
- 1.2.1 Weakly Interacting Massive Particles (WIMPs)

Freezeout and the WIMP Miracle

- 1.2.2 Massive Compact Halo Objects (MACHOs)
- 1.2.3 Axions
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2. The Search for Dark Matter

- 2.1 Types of search
- 2.1.1 Production Searches
- 2.1.2 Annihilation Searches
- 2.1.3 Scattering Searches
- 2.2 Fundamentals of direct detection
- 2.2.1 Energy spectrum
- 2.2.2 Annual modulation
- 2.2.3 Backgrounds

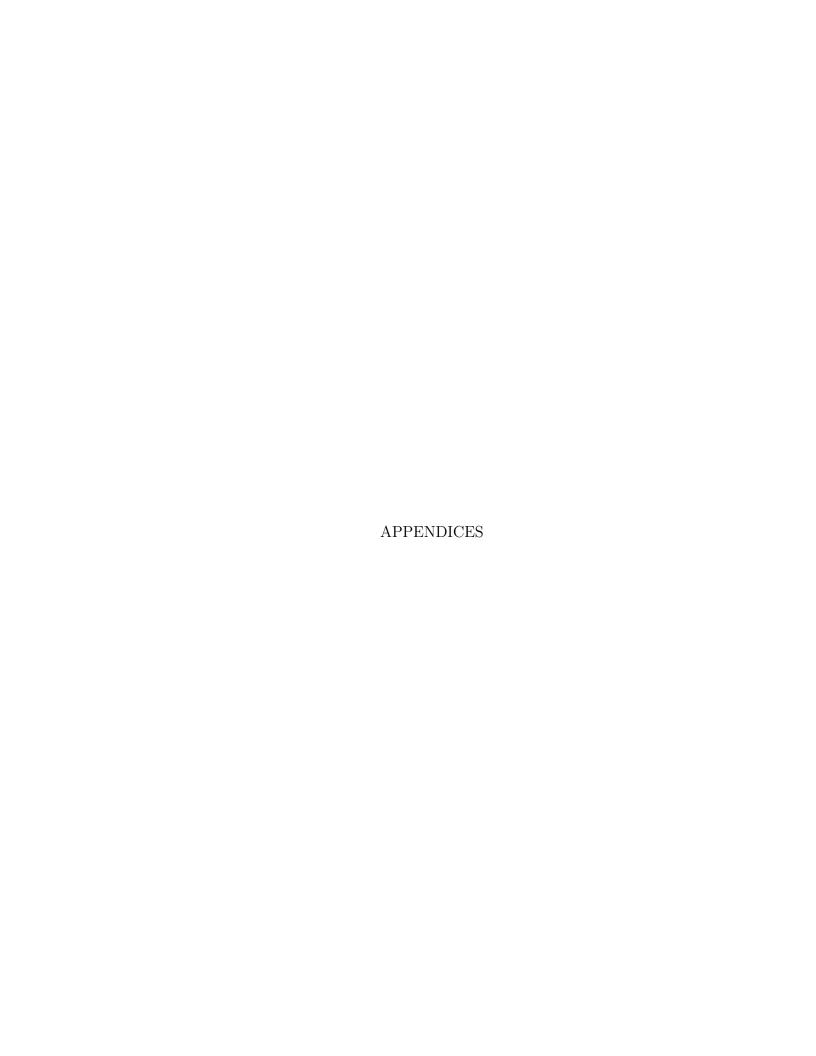
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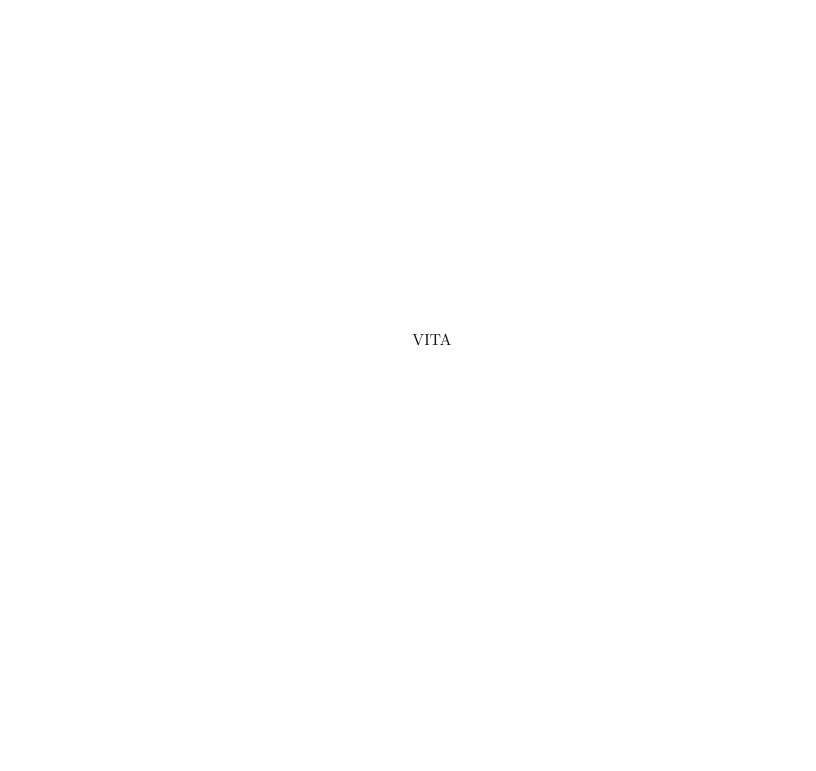
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- 3.2 System Overview
- 3.2.1 Water Cherenkov Muon Veto
- 3.2.2 Belt systems
- 3.2.3 Gas recirculation and purification
- 3.2.4 Electronics and DAQ
- 3.2.5 TPC and Umbilical

4. Single Electrons and UA'(1)

Slightly modified UA'(1) proposal.

5. Natural convection and the Radon veto





VITA

[Put a brief autobiographical sketch here.]