

# Retrofitting the Readout of a Large Interferometer in Washington

by

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Submitted to the Department of Physics  
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

at the

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Somebody



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## **Abstract**

The road approaching a direct detection of Gravitational Waves is long and hard, I am just one of many to walk this road. Here is my story.

Thesis Supervisor: Nergis Mavalvala

Title: Professor



# Acknowledgments

This is the acknowledgements section. You should replace this with your own acknowledgements.



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# Chapter 1

## Gravitational Radiation



## Chapter 2

# Experimental Efforts for Detection

### 2.1 iLIGO Interferometers





# Chapter 3

## Interferometer Retrofitting

### 3.1 Increased Input Laser Power

### 3.2 Re-engineered Thermal Compensation

### 3.3 Non-modulated Signal Extraction

#### 3.3.1 Optical Gain as Compared to RF Modulated Extraction

#### 3.3.2 Laser Noise Coupling

#### 3.3.3 The Need for a Mode Cleaner at the Output Port

#### 3.3.4 Quantum Shot Noise Reduction with Squeezed Light Injection



# Chapter 4

## The Output Mode Cleaner

### 4.1 Optical Design

#### 4.1.1 Optical Parameters

### 4.2 Mechanical Design and Seismic Isolation

### 4.3 Servomechanisms

#### 4.3.1 Cavity Length Control

#### 4.3.2 Alignment Control

### 4.4 Noise Sources Introduced in the OMC

#### 4.4.1 OMC Length Noise

#### 4.4.2 Beam Jitter Noise

Sensitivity to Beam Motion

Sources of Beam Jitter



# Appendix A

## Tables

Table A.1: Armadillos

Armadillos	are
our	friends



# Appendix B

## Figures

Figure B-1: Armadillo slaying lawyer.

Figure B-2: Armadillo eradicating national debt.



# Bibliography