Retrofitting the Readout of a Large Interferometer in Washington

by

Nicolas de Mateo Smith

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

Doctor of Philosophy

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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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

Thesis Co-supervisor: Peter Fritschel Title: Principal Research Scientist

Acknowledgments

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

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Experimental Efforts for Detection

The Theory of Readout Retrofitting

- 3.1 Increased Input Laser Power
- 3.2 Non-modulated Signal Extraction
- 3.2.1 Optical SNR as Compared to RF Modulated Signal Extraction
- 3.3 Output Mode Cleaner
- 3.4 Squeezed Light Injection

Performance of DC Readoud in Enhanced LIGO

- 4.1 Laser Noise Coupling
- 4.1.1 Numerical Model of Noise Couplings
- 4.1.2 Measurements of Noise Couplings
- 4.2 Optical SNR

The Output Mode Cleaner

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Sensitivity to Beam Motion

Sources of Beam Jitter

The Great Success of the H1 Squeezer Project

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.

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