

**YOUR
TITLE
HERE**



**A PROJECT WORK SUBMITTED TO THE
DEPARTMENT OF PHYSICS
TRI-CHANDRA MULTIPLE CAMPUS
INSTITUTE OF SCIENCE AND TECHNOLOGY
TRIBHUVAN UNIVERSITY
NEPAL**

**FOR THE AWARD OF
BACHELOR OF SCIENCE (B.Sc.) IN PHYSICS**

**BY
YOUR NAME HERE
SYMBOL NO: 1234567890
T.U. REGISTRATION NO: 0-0-00-000-0000**

[MONTH, YEAR]

RECOMMENDATION

This is to recommend that **Your Name Here**, Symbol No. 123456789, T.U. Registration No. 0-0-00-000-0000 has carried out project work entitled "**Your Project Name Here.**" for the requirement to the project work in Bachelor of Science (B.Sc.) degree in Physics under our supervision in the Department of Physics, Tri-Chandra Multiple Campus, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal.

To our knowledge, this work has not been submitted for any other degree. He has fulfilled all the requirements laid down by the Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal for the submission of the project work for the partial fulfillment of Bachelor of Science (B.Sc.) degree.

Asst. Prof. **Your Supervisor**

Supervisor

Department of Physics

Tri-Chandra Multiple Campus

Ghantaghar, Kathmandu

Your Co-Supervisor

Co-supervisor

Department of Physics

Tri-Chandra Multiple Campus

Ghantaghar, Kathmandu

DECLARATION

This project work entitled " **Your Project Name Here.** " is being submitted to the Department of Physics, Tri-Chandra Multiple Campus, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal for the partial fulfillment of the requirement to the project work in Bachelor of Science (B.Sc.) degree in Physics. This project work is carried out by me under the supervision of Asst. Prof. Supervisor, T.U., and co-supervision of Mr. co-supervisor, Department of Physics, Tri-Chandra Multiple Campus, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal.

This work is original and has not been submitted earlier in part or full in this or any other form to any university or institute, here or elsewhere, for the award of any degree.

.....

Signature

Name of student: Your Name Here

Symbol No: 123456789

T.U. Registration No: 0-0-00-000-0000

LETTER OF FORWARD

On the recommendation of **Mr. Co-Supervisor** and **Asst. Prof. Supervisor**, this project work is submitted by **Mr. Your Name Here**, **Symbol No. 123456789**, **T.U. Registration No. 0-0-00-000-0000**, entitled "**Your Project Name**" is forwarded by the Department of **Physics, Tri-Chandra Multiple Campus**, for the approval to the Evaluation Committee, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal. He has fulfilled all the requirements laid down by the Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal for the project work.

Asst. Prof. **Dept. Head**

Head, Department of Physics

Tri-Chandra Multiple Campus

Tribhuvan University

BOARD OF EXAMINATION AND CERTIFICATE OF APPROVAL

This project work (PRO-406) entitled " **Your Project Name** " by Mr. Your Name, Symbol No. 123456789 and T.U. Registration No. 0-0-00-000-0000 under the supervision of Mr. Supervisor and co-supervision of Mr. Co-Supervisor in the Department of Physics, Tri-Chandra Multiple Campus, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), is hereby submitted for the partial fulfillment of the Bachelor of Science (B.Sc.) degree in Physics. This report has been accepted and forwarded to the Controller of Examination, Institute of Science and Technology, Tribhuvan University, Nepal for the legal procedure.

Asst. Supervisor

Supervisor

Department of Physics

Tri-Chandra Multiple Campus

Tribhuvan University

Co-Supervisor

Co-Supervisor

Department of Physics

Tri-Chandra Multiple Campus

Tribhuvan University

External Examiner

Internal Examiner

Asst. Prof. Dept. Head

Head of Department

Department of Physics

Tri-Chandra Multiple Campus

Tribhuvan University

ACKNOWLEDGEMENT

Acknowledgement here.

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Your Name Here

Symbol No: 1234567890

T.U. Registration No: 0-0-00-000-0000

ABSTRACT

Gravitational Waves (GW) Your abstract here.

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Keywords: general theory of relativity, gravitational waves, matched-filtering, nested sampling, bayesian analysis

शोधसार

Printed separately and prepared in Word/Libre Office.

LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYMS

ET Einstein Telescope. 1

GW Gravitational Waves. vi

KAGRA Kamioka Gravitational Wave Detector. 1

LISA Laser Interferometer Space Antenna. 1

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CHAPTER 1

1. INTRODUCTION

1.1 General Introduction

General Introduction here (Abbott et al., 2016b) Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

1.2 Rationale

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1.3 Objectives

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- First Point.
- Second Point

CHAPTER 2

2. LITERATURE REVIEW

2.1 Introduction

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2.1.1 Introduction

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$$G_{\mu\nu} + \Lambda g_{\mu\nu} = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu} \quad (2.1)$$

where, $G_{\mu\nu}$ is Einstein tensor, Λ is cosmological constant, $g_{\mu\nu}$ is metric tensor, $R_{\mu\nu}$ is Ricci tensor, R is Ricci scalar, G is Gravitational constant, c is speed of light and $T_{\mu\nu}$ is Stress-energy Tensor with μ and ν running from 0 to 3, where 0 represents time coordinate and 1,2 and 3 represents three space coordinates.

$$h_{\mu\nu} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & h_+ & h_\times & 0 \\ 0 & h_\times & -h_+ & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \cos\left[\omega\left(t - \frac{z}{c}\right)\right] \quad (2.2)$$

This equation describes a real gravitational wave travelling in a positive z-direction. Here h_+ describes components of plus polarization and h_\times describes components of cross-polarization.

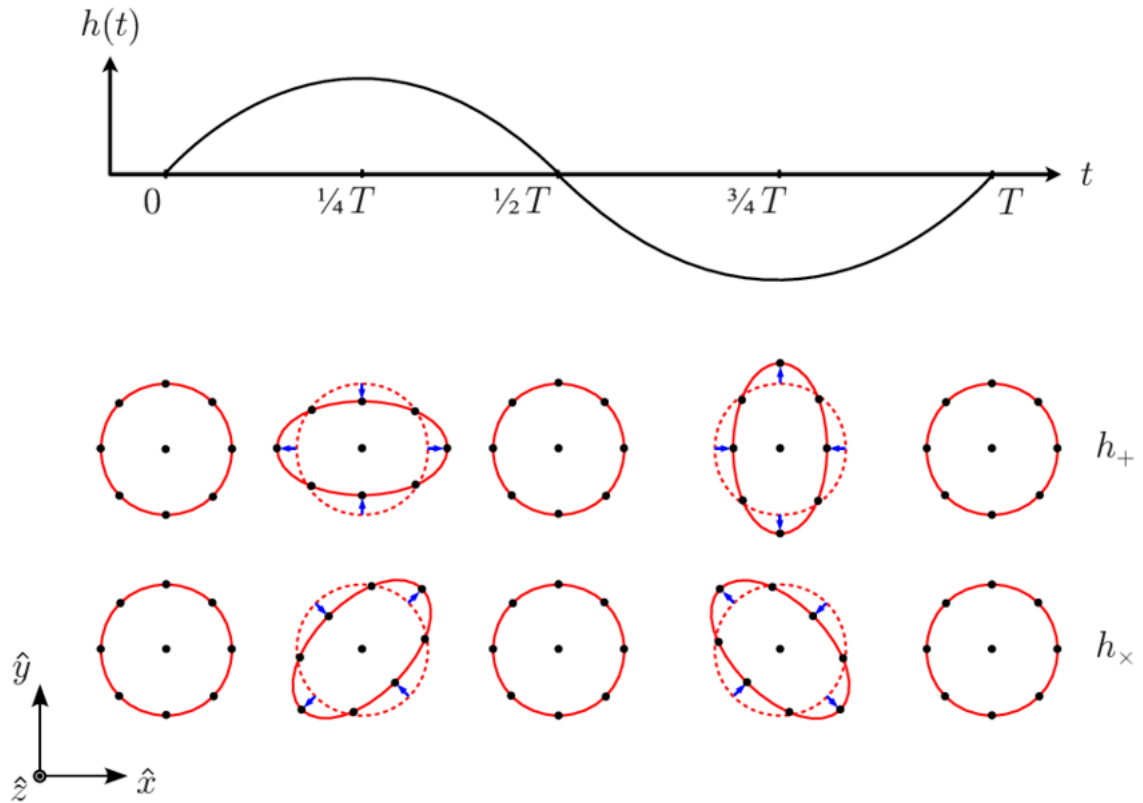


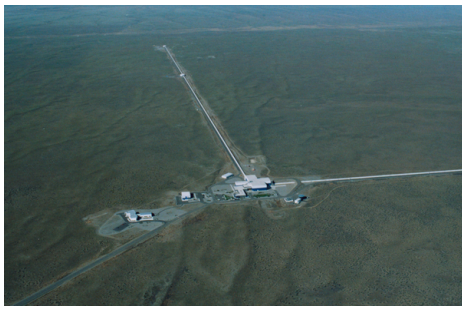
Figure 2.1: The oscillation of space-time caused by plus and cross-polarization of gravitational wave assuming the gravitational wave is coming out of the screen is shown over a period of oscillation. Image source: (Le Tiec & Novak, 2017)

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How to add multiple images under one fig name like fig.2.1(a)



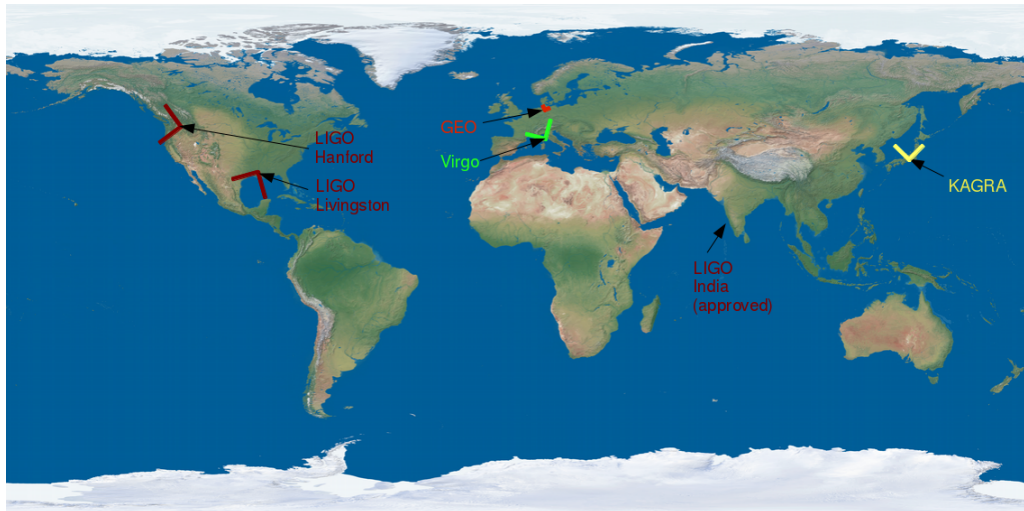
(a) Aerial view of LIGO, Livingston, Louisiana.
Image source: www.ligo.caltech.edu/



(b) Aerial view of LIGO, Hanford, Wash-
ington. Image source: www.ligo.caltech.edu/



(c) Aerial view of VIRGO, Italy. Image
source: www.ligo.caltech.edu/



(d) Current gravitational wave observatories and future projects Image source:
<http://public.virgo-gw.eu/a-worldwide-network/>

Figure 2.2: Different gravitational-wave observatories around the world.

CHAPTER 3

3. MATERIALS AND METHODS

3.1 Materials

Your Materials and methods here.

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CHAPTER 4

4. RESULTS AND DISCUSSION

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Table 4.1: Table caption here.

	col1	col2	α	η	γ	β	ϕ_{12}	ϕ_{jl}	dec	ra
0	0.735026	31.865548	0.044404	0.139142	1.236516	1.243803	6.022824	5.524391	-1.280793	1.399205
1	0.395492	26.254433	0.695270	0.707570	1.703324	1.549678	0.710867	5.278419	-1.114217	1.574433
2	0.733161	32.463685	0.026081	0.233599	1.072667	1.109643	3.346788	2.624136	-0.418368	2.691455
3	0.973735	32.098907	0.631578	0.820532	1.936246	1.353938	4.199511	4.315118	-1.133842	2.215548

Next Table reference.4.2

Table 4.2: Comparison of our results.

	Theoretical Results	Our result
Detector-frame total mass	$70.6^{+4.6\pm 0.5}_{-4.5\pm 1.3}$	$70.86^{+3.46}_{-3.2}$
mass	$30.4^{+2.1\pm 0.2}_{-1.9\pm 0.5}$	$30.65^{+1.48}_{-1.43}$
primary mass	$38.9^{+5.6\pm 0.6}_{-4.3\pm 0.4}$	$38.14^{+4.17}_{-2.97}$
secondary mass	$31.6^{+4.2\pm 0.1}_{-4.7\pm 0.9}$	$32.67^{+2.91}_{-4.1}$
total mass	$65.0^{+4.5\pm 0.8}_{-4.0\pm 0.7}$	$64.86^{+3.25}_{-3.33}$
Residual mass	$28.0^{+2.0\pm 0.3}_{-1.7\pm 0.3}$	$28.05^{+1.41}_{-1.44}$
Final mass	$35.8^{+5.3\pm 0.9}_{-3.9\pm 0.1}$	$34.88^{+4.54}_{-2.85}$
Final secondary mass	$31.6^{+4.2\pm 0.1}_{-4.7\pm 0.9}$	$29.84^{+2.79}_{-3.74}$
Ratio	$0.82^{+0.17\pm 0.01}_{-0.20\pm 0.03}$	$0.86^{+0.13}_{-0.18}$
magnitude	$0.32^{+0.49\pm 0.06}_{-0.29\pm 0.01}$	$0.31^{+0.58}_{-0.28}$
spin magnitude	$0.44^{+0.50\pm 0.08}_{-0.40\pm 0.02}$	$0.34^{+0.5}_{-0.3}$
distance	$410^{+160\pm 20}_{-180\pm 40}$	$449.96^{+136.24}_{-164.2}$
Redshift	$0.088^{+0.032\pm 0.005}_{-0.037\pm 0.008}$	$0.09^{+0.03}_{-0.03}$

In table 4.2, we see that we have two values for one parameter4.1.

$$z = \frac{D_L \cdot H_0}{c} \quad (4.1)$$

Here, H_0 is the Hubble's constant and c is the velocity of light.

CHAPTER 5

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusions

Your conclusion here. 4.2.

5.2 Recommendations for further work

recommendation for further work here.

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