

# AKSHITA MITTAL

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Indian Institute of Science Education and Research, Thiruvananthapuram  
Fifth-Year Integrated MS Student

## EDUCATION

**Integrated MS in Physics with Minor in Data Science** | IISER Thiruvananthapuram

**Expected: May 2024**

- CGPA: 3.6/4 (8.48/10)
- Relevant coursework: General Theory of Relativity and Cosmology — Astrophysics — Statistical and Data Analysis Methods in Astronomy — Electromagnetism and Special Theory of Relativity — Computational Techniques and Programming Languages — Machine Learning — Introduction to Probability — Introduction to Data Science — Nuclear and Particle Physics — Optics

## RESEARCH INTERESTS

Gravitational-wave astrophysics, waveform development, computational astrophysics, Bayesian statistics, machine learning, general relativity, cosmology, particle physics

## RESEARCH EXPERIENCE

**School of Physics, IISER Thiruvananthapuram**

**Aug 2023 – Present**

*Masters Project, PI: Dr Soumen Basak*

*Trivandrum, India*

- Exploring the impact of eccentricity on parameter estimation for binary sources detectable by LISA
- Building eccentric gravitational-wave (GW) data using TEOBResumS
- Currently accommodating Python library LISA Data Challenge (LDC) for TEOBResumS generated data

**Graduate School of Science, Kyoto University**

**May 2023 – Present**

*Machine Learning Project, PI: Prof. Takahiro Tanaka*

*Kyoto, Japan*

- Using an excess power method and convolutional neural network (CNN) for an all-sky search of continuous gravitational waves for DECIGO
- Estimated the parameter space and number of grid points to cover the whole sky
- Proposed and compared two methods to minimise the number of grid points
- Currently evaluating the computational cost of executing the CNN

**IISER Thiruvananthapuram × IUCAA**

**Jan 2023 – Apr 2023**

*Data Science Minor, PI: Dr Apratim Ganguly, Dr Shabnam Iyyani*

*Trivandrum, India*

- Conducted predictive GW analysis to explore underlying population distribution of compact binary parameters in the deci-hertz band
- Generated a black hole population, noise and signals using bilby and PyCBC
- Evaluated the signal-to-noise ratio (SNR) for different frequency bands
- Demonstrated enhanced capabilities of proposed deci-hertz observatory
- Compiled thesis titled 'Exploring the Scope of Multiband Detection with Next-Generation Gravitational Wave Detectors'

**Max Planck Institute for Gravitational Physics**

**July 2022 – Sept 2022**

*Remote Internship, PI: Dr Frank Ohme*

*Hannover, Germany*

- Used PyCBC to study effect of mass and distance on SNR of inspiralling binaries and on the mass of the graviton
- Studied modified dispersion relations in context of third-generation gravitational-wave detectors

**Inter-University Centre for Astronomy and Astrophysics**

**Apr 2021 – June 2021**

*Remote Internship, PI: Prof. Sanjit Mitra*

*Pune, India*

- Learnt to conduct injection studies and parameter estimation for binary merger events using the bilby framework
- Attained proficiency in Python programming within the Vim editor
- Conducted literature survey for the use of GW higher-order modes in post-merger data analysis

**Thapar Institute of Engineering and Technology**

**July 2020 – Sept 2020**

*Remote Internship, PI: Dr Mamta Gulati*

*Patiala, India*

- Meticulously studied 'Fundamental Astronomy' by Hannu Karttunen and 'Astrophysics for Physicists' by Arnab Rai Choudhari
- Delivered regular presentations showcasing notes and insights during weekly sessions

## AWARDS, HONORS, AND FELLOWSHIPS

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- Deutscher Akademischer Austauschdienst WISE (DAAD WISE)** **2022**  
• Selected for the DAAD WISE fellowship to support research with Dr Frank Ohme, MPI for Gravitational Physics, Hannover
- International Astronomy and Astrophysics Competition (IAAC)** **2020**  
• Awarded the Gold Honor in IAAC 2020 for promotion to the final level
- SIMIODE Challenge Using Differential Equations Modeling (SCUDEM)** **2020**  
• Received the Meritorious Award for solution on 'Problem A: Decay of Oil Agglomerates from the Deepwater Horizon Accident'
- Researchathon** **2020**  
• Received gold medal in national-level physics research competition organized by the National Institute of Technology, Surat, India

## WORKSHOPS

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- LISC Continuous Gravitational Waves Workshop** **2021**  
• Acquired a foundational understanding of utilizing PyFstat for the analysis of continuous gravitational-wave (CGW) data  
• Developed proficiency of CGW data analysis methods: matched filtering, F-statistic, parameter space metric
- LIGO-India Education and Public Outreach (LIEPO)** **2021**  
• Developed science communication for LIGO research, bridging the gap between academia and the wider public  
• Sharpened my writing and blogging skills through engaging interactions with experts in the field

## OUTREACH

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- Reading Between the Lines | Founder** **2023**  
• Founded an Ambedkarite anti-caste reading circle at IISER  
• Coordinating weekly book discussions and meetings to foster awareness and recognition of privilege  
• Promoting inclusivity on campus by actively advocating against casteism
- Inventa Magazine | Managing Editor** **2021-22**  
• Led an intercollegiate team from 7 IISERs, NISER, IISc, and CEBS in a year-long project  
• Facilitated seamless collaboration and inter-departmental correspondence for publication of a joint magazine
- Ether | Editor, Designer** **2020-22**  
• Fostered enriching discussions on literature and the arts through promotion of this dedicated magazine  
• Consistently met and exceeded all deadlines while handling editing and design responsibilities for the magazine
- Exhibit A | Editor, Designer** **2019-22**  
• Supported the evolution of IISER's official science newsletter with innovative ideas  
• Elevated my editorial and aesthetic proficiency by meticulously editing and designing >10 editions of the newsletter  
• Moderated interviews with eminent faculty in STEM
- Club of Mathematics, IISER Thiruvananthapuram (CMIT) | Coordinator** **2019-20**  
• Crafted the by-laws and foundational framework for IISER's official mathematics club  
• Proactively contributed to creating inclusivity in a traditionally male-dominated field

## PRESENTATIONS AND POSTERS

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- "Exploring the Scope of Multiband Detection with Next-Generation Gravitational Wave Detectors"** **2022**  
• Thesis presentation for minor degree in Data Science
- "How to Win an Internship: A Modern Guide to the Art of Applying"** **2022**  
• Delivered oral presentation to IISER students on advice to secure internships in STEM
- "A Star is [Un]Born: Understanding Stellar Collapse"** **2022**  
• Course project presentation for PHY5128: General Theory of Relativity and Cosmology
- "Estimating the Hubble Constant"** **2022**  
• Course project presentation for PHY5132: Statistical and Data Analysis Methods in Astronomy
- "Materials Science Approaches to Increase LIGO Detectors' Sensitivity"** **2021**  
• Presentation in online seminar organized by Society of Materials and Mechanical Engineers, IIT Ropar
- "Decay of Oil Agglomerates from the Deepwater Horizon Accident "** **2020**  
• Delivered oral presentation on mathematical modelling for SCUDEM V
- "P vs. NP: An Overview"** **2019**  
• Poster presentation of an introduction to the P vs. NP Millennium Prize Problem at the annual science fest *Anvesha*

## WORK EXPERIENCE

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### **Research Matters** | *Writer*

**2021-Present**

- Facilitating science communication to a broad audience through my contributions to the Gubbi Labs platform
- Conducting comprehensive literature reviews and readings across diverse subjects, including physics, climate change, and government policy

### **Dreamscape Media** | *Social Media Strategist*

**2021-Present**

- Collaborating with a notably experienced team on advertising and social media management
- Efficiently managing and organizing calendars, scheduling posts, and maintaining regular client interaction

## SKILLS AND MISCELLANEOUS

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### **Programming**

Python | R | MATLAB | Wolfram Mathematica

### **Modules**

bilby | gwosc | PyCBC | lisa | lalsuite

### **Markup**

Latex | HTML | CSS

### **Designing**

Adobe InDesign | Adobe Illustrator | Adobe Spark

### **Other Interests**

Activism | Hindustani music | Feminist and anti-caste literature