

Manvi Jain
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OVERVIEW

I am a physics graduate student with a strong foundation in gravitational wave astrophysics. My research primarily focuses on precessing binary searches. My research interests also include waveform modelling, normalizing flows and numerical analysis. I am a member of LIGO-Virgo-Kagra collaboration and I have experience with Gstlal pipelines, Bilby and Pycbc. Passionate about advancing theoretical and computational physics, I aim to contribute to cutting-edge research and foster diversity in STEM. Some contributions can be found at github.com/manvij1612

EDUCATION

<i>PhD. in Engineering and Applied Science, University of Massachusetts Dartmouth</i>	2025 -
• <i>Advisor:</i> Prof. Sarah Caudill	
<i>M.S. in Physics, University of Massachusetts Dartmouth</i>	2023 - 2025
• <i>Thesis:</i> "Harmonic decomposition versus metric-based template banks in precessing gravitational-wave searches"	
• <i>Advisor:</i> Prof. Sarah Caudill	
<i>B.Tech. in Electrical & Electronics Engineering, Indraprastha University (GGSIPU)</i>	2018 - 2022
• <i>Major Project:</i> "Self-driving cars using raspberry pi"	
• <i>Minor Project:</i> "Simulating and designing a high-powered rocket "	
• <i>Advisor:</i> Prof. Ashok Goyal	

APPOINTMENTS

<i>Doctoral Fellow, UMass Dartmouth</i>	2025 -
• Awarded competitive fellowship supporting my research and coursework.	
• Completing advanced coursework including scientific machine learning, advanced numerical methods for PDEs and high performance scientific computing.	
• Exploring research projects in numerical analysis and gravitational-wave data analysis like template bank construction, matched filtering, high-order numerical methods for hyperbolic systems.	

Research Assistantship, UMass Dartmouth

2024 - 2025

- Conducted precessing searches using Gstlal on O1 and O2 data.
- Packaged a precessing harmonics generation code for future simplicity.
- Introduced weak and non-gaussian glitches on a simulated gravitational-wave signal to look for possible deviations.

Teaching Assistantship, UMass Dartmouth

2023 - 2024

- Demystified topics in classical physics for better understanding of the students.
- Positioned as head TA for the mechanics lab.

Trainee: Academics, STEM & Space

2023

- Delivered topics like rocketry, volcanoes, spectroscopy, and cosmic calendar to 40+ students.
- Organized solar observing sessions involving viewing sunspots through telescopes.

Astronomy Teacher and Asst. R & D Manager, Spark Astronomy Pvt. Ltd.

2022

- Taught astronomy to all age groups.
- Designed different levels of astronomy courses (beginner, intermediate and advanced).
- Assisted with designing several working models of Physics for astronomy labs.
- Created digital training content for astronomy laboratories for 10+ schools.

Science Communicator, Genex Space

2021

- Communicated the principles, works, findings, and implications of space science topics like astronomy, rocket science, astrobiology through videos and blogs.
- Helped organize a panel discussion for women in STEM.

Science Communicator & Astronomy Changemaker, Spaceonova Pvt. Ltd.

2021

- Created digital content for social media platforms related to space science, receiving over 6,000 views across three videos.
- Planned basic and advanced lesson plans on stellar astronomy and astrophysics.

Intern, IIT Bombay

2020

- Learnt about artificial intelligence, deep learning and machine learning.
- Made a few projects including live digit recognizing, breast cancer detecting.

PUBLICATION AND PRESENTATIONS

"Harmonic decomposition versus metric-based template banks in precessing gravitational-wave searches: a thesis in Physics", *University of Massachusetts Dartmouth*, 10.62791/20482, 2025. 2025

"Searching for Asymmetric and Heavily Precessing Binary Black Holes in the Gravitational Wave Data from the LIGO Third Observing Run", *Phys. Rev. Lett.*, 133:201401, Nov 2024. 2024

2 Provisional (2021 QJ70, 2021 QD44) and 10 Preliminary Discoveries of Asteroids in the Main Asteroid Belt, *International Astronomical Search Collaboration* 2021

TALKS GIVEN:

- *Lightning talk and poster presentation*, "Harmonic decomposition versus metric-based template banks in precessing gravitational-wave searches", Georgia Tech University 2025
- *15 min talk*, "Harmonic decomposition versus metric-based template banks in precessing gravitational-wave searches", Brown University 2025
- *12 min talk*, "Exploring long duration gravitational waves from binary neutron stars using mbank", UMass Dartmouth 2025

ORGANIZED:

- *STEM4Girls*, "Detecting gravitational waves", UMass Dartmouth 2024
- *Workshop on stargazing*, "Night sky observation using telescope", STEM & Space 2023
- *Workshop on solar observation*, "Sun spots observation using telescope", STEM & Space 2023

INVITED:

- *Guest Speaker*, "Life cycle of stars", Math and beyond: A nerdy podcast 2023

MODERATED:

- *Chair of Panel*, "Scope of privatization in the space industry", SSERD 2022

ATTENDED:

- *GWPW (Gravitational wave physics and astronomy workshop)*, Georgia Tech University 2025
- *APS New England section annual meeting*, Brown University 2025
- *SGN (Stream graph navigator) retreat*, Penn State University 2024
- *WiDS (Women in data science) datathon*, Microsoft NERD center 2024
- *Artificial intelligence workshop*, IIT Bombay 2020
- *Mission discovery project*, ISSET Singapore 2019

TRAINING AND SKILLS**PROJECTS (CODING BASED):**

- "Ridge regression via SGD in JAX: A study" 2025
- "Particle Physics Problem: A physics-informed classifier to distinguish between different particles using gaussian discriminant analysis and Random Forest" 2025
- "Predict pulsar classes using gaussian mixture models" 2025
- "CNNs for signal detection: Can a linear classifier beat the matched filter?" 2025
- "Numerical hamiltonian for a 1D harmonic oscillator" 2025
- "Basic implementations of numerical methods to solve ordinary differential equations" 2025
- "Comparison between different schemes to solve one way wave equation" 2025
- "Parallel implementation of linear regression using gradient descent with OpenMP in C" 2024
- "Distributed monte carlo optimization of a Rosenbrock-type function" 2024

PROJECTS (THEORETICAL):

- "Alternative Model of Gravity: Massive Graviton Theory", UMass Dartmouth 2024
- "Systems with Negative Specific Heat: Gravothermal Catastrophe", UMass Dartmouth 2024
- "The Reality Behind Field Theoretic Description of Gravity: A Review", UMass Dartmouth 2024
- "2D Conformal Field Theory", UMass Dartmouth 2023
- "Working of Maglev Trains", GGSIPU 2021

COURSES/TRAINING COMPLETED:

- "Cybersecurity training", UMass Dartmouth 2026
- "Data security training", UMass Dartmouth 2024
- "Research ethics and code of conduct", UMass Dartmouth 2023
- "Astrophysics: cosmology course", Australian National University 2022
- "Summer school on astrophysics & cosmology", IUCAA 2021
- "Telescopes & astrophotography", Spaceonova Pvt. Ltd. 2021
- "Building a high powered rocket system using OpenRocket, EagleCAD, TinkerCAD, Fusion 360 & Proteus", STAR 2021

COMPUTING SKILLS:

- "*Languages*: Proficient in Python, Julia and MATLAB. Familiar with C/C++ and Mathematica.
- "*Operating systems*: MacOS, Linux. Experience with working on high performance supercomputers.

TEACHING/MENTORING

Electricity and Magnetism: PHY 104, *Summer Teaching Assistant*, UMass Dartmouth 2025

- Explained concepts through experiments, like electrostatics, electric field and Gauss's law, capacitors, magnetism and RC and LR circuits.
- Took office hours/tutoring sessions for problems and concepts related to electricity and magnetism

Classical Mechanics: PHY 102, *Teaching Assistant*, UMass Dartmouth 2023-2024

- Taught concepts like Newton's laws of motion, passive forces, friction, gravity, momentum conservation through Logger Pro software
- Organized tutoring sessions for numerical problems and concepts related to classical physics

COURSES TAUGHT:

- "Auroras: how they are formed", Spark Astronomy, Genex Space 2021-2022
- "Stellar Astronomy: The Life Cycle of Stars", Spaceonova Pvt. Ltd., Genex Space 2021
- "Space Telescopes", STEM & Space, Genex Space 2021
- "Working of Rockets", Genex Space 2021
- "International Space Station", Genex Space 2021
- "Space Debris and its effects", Space Debris 2021

VOLUNTEERED:

- *Workshop on "Gravitational waves: working of LIGO"* for *STEM4Girls* , UMass Dartmouth 2025

- *Chaperon for STEM4Girls* , UMass Dartmouth 2023
- *Teacher and Mentor for underprivileged children*, Pehchaan the Street School 2019-2020