

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

PhD. in Engineering and Applied Science, University of Massachusetts Dartmouth 2025 -

- *Advisor:* Prof. Sarah Caudill

M.S. in Physics, University of Massachusetts Dartmouth 2023 - 2025

- *Thesis:* "Harmonic decomposition versus metric-based template banks in precessing gravitational-wave searches"
- *Advisor:* Prof. Sarah Caudill

B.Tech. in Electrical & Electronics Engineering, Indraprastha University (GGSIPU) 2018 - 2022

- *Major Project:* "Self-driving cars using raspberry pi"
- *Minor Project:* "Simulating and designing a high-powered rocket "
- *Advisor:* Prof. Ashok Goyal

APPOINTMENTS

Doctoral Fellow, UMass Dartmouth 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.

<i>Research Assistantship, UMass Dartmouth</i>	2024 - 2025
<ul style="list-style-type: none"> • 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. 	
<i>Teaching Assistantship, UMass Dartmouth</i>	2023 - 2024
<ul style="list-style-type: none"> • Demystified topics in classical physics for better understanding of the students. • Positioned as head TA for the mechanics lab. 	
<i>Trainee:Academics, STEM & Space</i>	2023
<ul style="list-style-type: none"> • Delivered topics like rocketry, volcanoes, spectroscopy, and cosmic calendar to 40+ students. • Organized solar observing sessions involving viewing sunspots through telescopes. 	
<i>Astronomy Teacher and Asst. R & D Manager, Spark Astronomy Pvt. Ltd.</i>	2022
<ul style="list-style-type: none"> • 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. 	
<i>Science Communicator, Genex Space</i>	2021
<ul style="list-style-type: none"> • 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. 	
<i>Science Communicator & Astronomy Changemaker, Spaceonova Pvt. Ltd.</i>	2021
<ul style="list-style-type: none"> • 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. 	
<i>Intern, IIT Bombay</i>	2020
<ul style="list-style-type: none"> • 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", <i>University of Massachusetts Dartmouth</i> , 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", <i>Phys. Rev. Lett.</i> , 133:201401, Nov 2024.	2024
2 Provisional (2021 QJ70, 2021 QD44) and 10 Preliminary Discoveries of Asteroids in the Main Asteroid Belt, <i>International Astronomical Search Collaboration</i>	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:

- *GWPAW (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