Chayan Chatterjee, PhD

AI for New Messengers Postdoctoral Fellow · Gravitational Wave Astronomy & Data Analysis · Machine Learning

Department of Physics and Astronomy, Data Science Institute, Vanderbilt University

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Educational Qualification

AI for New Messengers Postdoctoral Fellow

Tennessee, USA

Vanderbilt University

Dec. 2023 - now

- Joint fellowship by the Department of Physics and Astronomy and Data Science Institute at Vanderbilt University

PhD in Physics

Perth, Australia

The University of Western Australia

Feb 2020 - Nov 2023

- **Thesis title:** Enabling rapid discovery of gravitational waves using machine learning.
  Supervisors: Prof. Linqing Wen, Prof. Amitava Datta.

M.Sc. in Physics | List of courses

Kolkata, India

Presidency University

2016 - 2018

- **Thesis title:** Dark matter self interaction and its impact on large scale structures.
  Supervisors: Prof. Debashish Majumdar, Prof. Suchetana Chatterjee.

B.Sc. (with Hons.) in Physics | List of courses

Kolkata, India

Presidency University

2013 - 2016

- **Thesis title:** The Hertzsprung-Russell diagram of stars in the SDSS Stripe-82 Catalog.
  Supervisor: Prof. Saumyadip Samui

Research Interests

My research broadly focuses on developing machine learning methods and Bayesian inference techniques for gravitational-wave data from current and future observatories. I specialize in deep learning and foundational AI to enhance search sensitivity, improve parameter estimation, and characterize detector noise. Through these methods, I aim to advance our understanding of compact binaries and their formation and evolution. My research interests include:

Deep learning for LIGO

During my PhD, I developed **GW-SkyLocator**, the first deep-learning model for estimating the sky-positions of compact binary mergers. I have developed **AWaRe**, a neural network for reconstructing gravitational wave signals from noisy LIGO data, and **CASTOR**, a fast transformer pipeline for gravitational-wave searches in LIGO.

Foundational AI for GWs

I have pioneered the adaptation of audio foundation models for gravitational-wave searches and noise characterization. This includes **GW-Whisper**, an adaptation of OpenAI's Whisper, and **Audio Spectrogram Transformer**, a large vision-transformer trained on speech data.

Interpretable AI & Leadership

I lead initiatives bridging rigorous physical interpretability and community-wide machine learning standardization. This includes introducing symbolic regression to extract closed-form physical equations and post-merger observables (**Chatterjee et al. 2026**), and co-authoring the definitive open community benchmark and best-practice roadmap for AI in gravitational-wave astronomy (**Nature Astronomy 2026**).

Recent Publications

Total: 18 | First author: 11 | Non-First Author: 7. For a full list of my publications, please visit this link.

"The multimessenger Universe as a training ground for frontier AI"

Nature Astronomy

Abigail Petulante, Chayan Chatterjee, Karan Jani et al.

Nat Astron 10, 938–946 (2026)

- Perspective article discussing how multimessenger astronomy can contribute towards developing trustworthy frontier AI, with a community roadmap for supporting that goal.

"Machine Learning Confirms GW231123 is a 'Lite' Intermediate-Mass Black Hole Merger"

The Astrophysical Journal Letters

Chayan Chatterjee, Kaylah McGowan, Suyash Deshmukh and Karan Jani

ApJL 995 L6 (2025)

- Confirmed GW231123 as a "lite" intermediate-mass black hole merger (≈ 190–265 $M_\odot$) using combined machine learning methods that correctly identifies the merger, characterizes the glitches close to the event and performs model-agnostic waveform reconstruction of the event.

"No Glitch in the Matrix: Robust Reconstruction of Gravitational Wave Signals under Noise Artifacts" — *The Astrophysical Journal*

Chayan Chatterjee and Karan Jani — *ApJ 982 102 (2025)*

- We show that gravitational-wave signals can be accurately reconstructed using our neural network, even in the presence of glitches – without being explicitly trained on signals contaminated by glitches.

"Rapid Localization of Gravitational Wave Sources from Compact Binary Coalescences Using Deep Learning" — *The Astrophysical Journal*

Chayan Chatterjee, Manoj Kovalam, Linqing Wen, Damon Beveridge, Foivos Diakogiannis, and Kevin Vinsen — *ApJ 959 42 (2023)*

- We propose GW-SkyLocator, a normalizing flow-based deep learning method that produces accurate sky localization posteriors for all types of compact binary coalescences orders of magnitude faster than traditional Bayesian techniques.

- In a follow-up work, we show that GW-SkyLocator performs sky-localization of binary neutron star mergers 0-60 seconds before merger, achieving comparable localization areas to BAYESTAR at vastly reduced computational latency. The paper can be found here.

Notable Scholarships, Awards & Grants

2025	**Winner**, Lacy-Fischer Interdisciplinary Research Grant ($7500)	*Vanderbilt U.*
2023	**Winner**, AI for New Messengers Postdoctoral Fellowship	*Vanderbilt U.*
2022	**Winner**, Best Student Talk, Australian Mathematical Sciences Institute Summer School	*AMSI*
2022	**2nd Place**, J-P Macquart Best Student Talk Award, Australian National Institute for Theoretical Astrophysics	*ANITA*
2022	**Winner**, UWA Postgraduate Student Association Travel Award	*UWA*
2022	**Winner**, OzGrav Travel Award	*OzGrav*

Selected Presentations

For a full list of presentations, please see this link.

Invited Talk: Department of Astronomy Seminar — *Presidency U., Kolkata*

Gravitational Wave Astronomy in the Era of Foundational AI — *Oct. 2025*

Invited Talk: Department of Physics Weekly Seminar — *U. of Western Australia, Perth*

Towards a Foundational AI Model for Gravitational Waves — *Mar. 2025*

Invited Talk: Institute for Gravitational Research Seminar — *U. of Glasgow, Glasgow*

Reconstruction & Parameter Estimation of Gravitational Waves Using Deep Learning — *May 2024*

Invited Talk: Gravitational Wave Astronomy Group Seminar — *Monash U., Melbourne*

Rapid Sky Localization & Waveform Extraction of Gravitational Waves Using Deep Learning — *Mar. 2023*

Invited Talk: Center for Gravitation, Cosmology and Astrophysics Seminar — *U. of Wisconsin, Milwaukee*

Rapid Sky Localization & Waveform Extraction of Gravitational Waves Using Deep Learning — *Feb. 2023*

Invited Talk: Department of Physics seminar talk — *Western Sydney University, Sydney*

Denoising and Parameter Estimation of Gravitational Waves Using Deep Learning — *Aug. 2021*

Major Positions of Responsibility

Academic Services

Present	**Guest Editor**, MDPI Galaxies Special Issue: Machine Learning for Multimessenger Sources and Their Astrophysical Environments	*2026*
Present	**Journal Referee**, Nature Scientific Reports, Nature Communications Physics, Physical Review D, The Astrophysical Journal, International Journal of Modern Physics D, Astrophysics and Space Science, Science China Physics, Mechanics and Astronomy.	*2020 - now*
Present	**Review Chair**, LIGO Data Quality Report	*2024 - now*
2025	**Organizing Committee**, Multimessenger Astronomy in the Era of Foundational AI Workshop, Vanderbilt U.	*2025*
2024	**Chair**, OzGrav Gravitational Wave Inference Research Program	*2023-2024*
2022	**Core Committee Member**, Australian National Institute for Theoretical Astrophysics	*2021-2022*
2021	**Organizing Committee**, UWA Research Week	*2020-2021*

Teaching & Mentoring

Present	**Research Mentor**, Mentored/Supervised 12 undergraduate & graduate students at UWA and Vanderbilt U.	*2020 - now*
Present	**Guest Lecturer**, Black Holes in Our Universe (ASTR-2190), Vanderbilt University	*2024 - now*
2023	**Lecturer**, Gravitational Wave Astronomy (PHYS4420), University of Western Australia.	*2022 - 2023*
2023	**Teaching Facilitator**, Our Universe (SCIE1121), University of Western Australia.	*2020 - 2023*

Science Outreach

2024	**Presenter**, Astronomy on Tap - Nashville	*Nashville*
2024	**Judge**, Visualize Your Thesis Competition, The University of Western Australia	*Perth*
2021-24	**Mentor**, UWA Three Minute Thesis Competition	*Perth*
2022	**Presenter**, Pint for Science, Australia	*Perth*
2021	**Invited Guest**, Podcast, “Curiosity Killed the Rat”	*Online*
2021	**Invited Guest**, Podcast, “Astrophiz: An Astronomy Podcast”	*Online*
2021	**Invited Guest**, Perth Fringe Festival Talk Show, “The Uncertainty Principle Presents: Science After Dark”	*Perth*

Organizational & Advocacy

Present	**Fisk-Vanderbilt Bridge Program**, Mentoring underrepresented minorities in astronomy	*2024 - now*
2022	**Early Career Researcher Representative, OzGrav**, Nominated member from UWA node	*2021 - 2022*
2022	**Mentor & Organizer**, NASA Space Apps Challenge, Perth	*2021-2022*
2021	**Postgraduate Student Association, UWA Student Guild**, Elected Research Representative	*2020 - 2021*

Technical Skills

Machine Learning	Proficient in PyTorch, TensorFlow and Keras
Programming	Proficient in Python. Working knowledge of R, IDL, FORTRAN and HTML.
HPC Computing	Have used multiple large HPC facilities. Proficient in SLURM, HTCondor schedulers.
Software Development	Proficient in Git, GitHub, GitLab.

Scientific Collaborations

LIGO-Virgo-KAGRA Collaboration	Member since 2019.
American Astronomical Society	Member since 2023.
American Physical Society	Member since 2020.
OzGrav	Member from 2019-2023.
Astronomical Society of Australia	Member from 2020-2023.
Australian Institute of Physics	Member from 2020-2023.