

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

VANDERBILT UNIVERSITY

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

Tennessee, USA

Dec. 2023 - now

PhD in Physics

THE UNIVERSITY OF WESTERN AUSTRALIA

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

Perth, Australia

Feb 2020 - Nov 2023

M.Sc. in Physics | List of courses

PRESIDENCY UNIVERSITY

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

Kolkata, India

2016 - 2018

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

PRESIDENCY UNIVERSITY

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

Kolkata, India

2013 - 2016

Research Interests

My research focuses on developing foundational AI models to improve the sensitivity of gravitational-wave searches, parameter estimation, and detector characterization, thereby enabling the discovery of new types of signals and providing robust insights into the physics of compact objects and the early universe. Some of the projects I have developed are:

Detection

We have developed **GW-Whisper** the first cross-domain application of OpenAI's Whisper model to gravitational waves, demonstrating that with minimal fine-tuning, pre-trained large audio transformers can be adapted for gravitational wave searches and glitch classification.

Waveform Reconstruction

We have developed **AWaRe** or Attention-boosted Waveform Reconstruction network, a neural network for reconstructing gravitational wave signals from LIGO data, enhancing signal fidelity even in noisy or glitchy environments, and generalizing to unseen waveform features like eccentricity.

Sky Localization

During my PhD, I developed **GW-SkyLocator**, the first deep-learning model for estimating the sky-position distributions of all types of compact binary mergers, including pre-merger localization of binary neutron star systems, enabling rapid electromagnetic follow-up.

Recent Publications

Total: 12 | First author: 9 | Non-First Author: 3. For a full list of my publications, please visit this [link](#).

“Pre-trained Audio Transformer as a Foundational AI Tool for Gravitational Waves”

CHAYAN CHATTERJEE, ABIGAIL PETULANTE, YANG HU, ROY LAU, SUYASH DESHMUKH, HAOWEI FU, TRANG HOANG, STEPHEN CHONG ZHAO, JESSE SPENCER-SMITH, KARAN JANI

Under review in Nature Communications Physics.

ArXiv: 2412.20789 (2024)

- Introduced GW-Whisper, which fine-tunes OpenAI's Whisper (pre-trained on generic audio) for detecting gravitational-wave signals and classifying transient noise artifacts (“glitches”).

“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 ($\approx 190\text{--}265 M_{\odot}$) 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 DIAKOIANNIS, 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](#).

Scholarships, Awards and Grants

2023	Winner , AI for New Messengers Postdoctoral Fellowship	<i>Vanderbilt U.</i>
2022	Winner , Best Student Talk, Australian Mathematical Sciences Institute Summer School	<i>AMSI</i>
2022	2nd Place , J-P Macquart Best Student Talk Award, Australian National Institute for Theoretical Astrophysics	<i>ANITA</i>
2022	Winner , UWA Postgraduate Student Association Travel Award	<i>UWA</i>
2022	Winner , OzGrav Travel Award	<i>OzGrav</i>
2022	2nd Place , UWA Postgraduate Student Association Research Week Best Talk Award	<i>UWA</i>
2021	Winner , J-P Macquart Best Student Talk Award, Australian National Institute for Theoretical Astrophysics	<i>ANITA</i>
2021	Winner , OzGrav Outreach Superstar Award (Western Australia)	<i>OzGrav</i>
2021	Finalist , FameLab, International Science Communication Competition	<i>FameLab, WA</i>
2020	Winner , Scholarship for International Research Fees and Living Allowance	<i>UWA</i>
2020	Winner , University of Western Australia Three Minute Thesis (3MT) Competition	<i>UWA</i>
2020	People’s Choice Award , University of Western Australia Three Minute Thesis (3MT) Competition	<i>UWA</i>
2020	Finalist , Matariki Network of Universities (MNU) Three Minute Thesis Competition	<i>International</i>
2017	Winner , IISER Thiruvananthapuram Visiting Research Student Fellowship	<i>IISER-TVM</i>

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	Journal Referee , Nature Scientific Reports, Nature Communications Physics, 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.