

# 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.

## Notable Publications

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

### “Reconstruction of Binary Black Hole Harmonics in LIGO Using Deep Learning”

*The Astrophysical Journal*

CHAYAN CHATTERJEE AND KARAN JANI

ApJ 969 25 (2024)

- We demonstrate a deep-learning model (AWaRe) that reconstructs binary black hole signals including precession and higher-order harmonics from real LIGO data with high fidelity, achieving overlaps of 0.85–0.98 on real events relative to both modeled and unmodeled benchmarks.
- We follow this work with an enhanced version of AWaRe that not only reconstructs binary black hole signals from real LIGO data including unseen features like eccentricity, high masses, and extra harmonics, but also estimates uncertainty in its reconstructions which align with benchmark methods like BayesWave and coherent WaveBurst. The paper can be found here.

## The Astrophysical Journal

*ApJ* 982 102 (2025)

- ## “Rapid Localization of Gravitational Wave Sources from Compact Binary Coalescences Using Deep Learning”

The Astrophysical Journal

*ApJ* 959 42 (2023)

- ## Scholarships, Awards & Grants

## Selected Presentations

**Invited Talk: Department of Astronomy Seminar**

Presidency U., Kolkata

Oct. 2025

**Invited Talk: Department of Physics Weekly Seminar**

U. of Western Australia, Perth

Mar. 2025

**Invited Talk: Institute for Gravitational Research Seminar**

U. of Glasgow, Glasgow

May 2024

**Invited Talk: Gravitational Wave Astronomy Group Seminar**

Monash U., Melbourne

Mar. 2023

**Invited Talk: Center for Gravitation, Cosmology and Astrophysics Seminar**

U. of Wisconsin, Milwaukee

Feb. 2023

**Invited Talk: Department of Physics seminar talk**

Western Sydney University, Sydney

Aug. 2021

## Major Positions of Responsibility

## ACADEMIC SERVICES

Present	<b>Journal Referee</b> , 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	<b>Review Chair</b> , LIGO Data Quality Report	2024 - now
2025	<b>Organizing Committee</b> , Multimessenger Astronomy in the Era of Foundational AI Workshop, Vanderbilt U.	2025
2024	<b>Chair</b> , OzGrav Gravitational Wave Inference Research Program	2023-2024
2022	<b>Core Committee Member</b> , Australian National Institute for Theoretical Astrophysics	2021-2022
2021	<b>Organizing Committee</b> , UWA Research Week	2020-2021

## TEACHING & MENTORING

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

## SCIENCE OUTREACH

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

## ORGANIZATIONAL & ADVOCACY

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

## Technical Skills

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

## Scientific Collaborations

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