



Himanshu Tiwari

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🔄 github.com/himmng

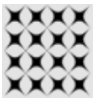
🌐 <https://himmng.github.io/>

RESEARCH INTERESTS

Cosmic-Dawn and Epoch of Reionization, 21-cm Cosmology, Fast Radio Bursts (FRBs), Exoplanets

RESEARCH EXPERIENCE

Radio Interferometric observations, Imaging, Large-volume simulations, Big Data & Machine Learning, Bayesian Statistics, Visualisation Tools.



MWA, Murchison Widefield Array

Using First-hand MWA observational data for my ongoing PhD projects.

Pipeline developed — **Lunar Occultation, Closure phase analysis**



HPC, High-Performance Computing

Used various HPC clusters in various stages of the research projects. Some of them are **Garrawarla**: Pawsey Supercomputing Centre, **Shakti**: Indian Institute of Technology Kharagpur (IITKGP), **HPC (cosmology group)**: Indian Institute of Technology Indore (IITI).



MACHINE LEARNING, Artificial Neural Network (ANN)

Used Machine Learning (Artificial Neural Networks) to emulate the **21-cm signal statistics** and **Bayesian Inference** to constrain the astrophysical model parameters of the Epoch of Reionization.

Pipeline developed: **EmuPBk**- ANN based statistical signal emulator of Epoch of Reionization.

EDUCATION

PH.D. RADIO ASTRONOMY

2021 – present



Curtin Institute of Radio Astronomy, Curtin University, Australia

Thesis Title: Radio Interferometric Tools to study the early Universe.

Supervisors: Prof. Cathryn Trott, Dr. Nithyanandan Thyagarajan, Dr. Benjamin McKinley, A/Prof. Randall Wayth.

M.SC. ASTRONOMY

2018 – 2020



Indian Institute of Technology Indore, India

Thesis Title: Developing Statistical Inference Tools for Future Observations of the Cosmic Dawn and the Epoch of Reionization. [Link](#)

Supervisor: A/Prof. Suman Majumdar

B.SC.

2013 – 2016



Kumaon University, Nainital, India

Bachelor of Science with Physics, Mathematics and Chemistry major.

ADDITIONAL AFFILIATIONS



CSIRO, Australia Telescope National Facility (ATFN)

2022 – present

ATFN graduate research student at Commonwealth Scientific and Industrial Research Organisation (CSIRO)



ICRAR, PhD research scholar

2021 – present



PhD research scholar at Curtin Node of International Centre for Radio Astronomy Research (ICRAR)

PUBLICATIONS

COSMIC DAWN & EPOCH OF REIONISATION (CD-EoR)

1. **Interpreting multi-wavelength observations from next-generation telescopes using ANN-based emulators:** Interpreting CII line intensity map power spectrum using ANN-based emulators.
S. Dutta, S. Majumdar, C. Murmu and H. Tiwari {In preparation}
2. **Prospect of global 21-cm signal from Moon:** A case study of lunar regolith using MWA for future radio experiments.
Himanshu Tiwari, Benjamin McKinley, Cathryn M. Trott, Nithyanandan Thyagarajan {In progress}
3. **Mitigating MWA antenna-based systematics:** Improved closure phase 21-cm power spectrum upper limits with MWA phase II.
Himanshu Tiwari, Nithyanandan Thyagarajan, Cathryn M. Trott, Benjamin McKinley, {In progress}
4.  **21cm Epoch of Reionisation Power Spectrum with Closure Phase using the Murchison Widefield Array.**
Himanshu Tiwari, Nithyanandan Thyagarajan, Cathryn M. Trott, Benjamin McKinley, {under review PASA}
5.  **Measuring the global 21-cm signal with the MWA-II:** improved characterisation of lunar-reflected radio frequency interference
Himanshu Tiwari, Benjamin McKinley, Cathryn M. Trott, Nithyanandan Thyagarajan {published PASA: DOI}
6.  **Improving constraints on the reionisation parameters using 21-cm Bispectrum** Himanshu Tiwari, Abinash Kumar Shaw, Suman Majumdar, Mohd. Kamran, Madhurima Choudhury {published Jcap: DOI}

FAST RADIO BURSTS (FRBs)

1.  **Modelling the energy distribution in CHIME/FRB Catalog-1** Siddhartha Bhattacharya, Somnath Bharadwaj, Himanshu Tiwari, Suman Majumdar {published MNRAS: DOI}
2.  **A maximum likelihood estimate of the parameters of the FRB population** Siddhartha Bhattacharya, Himanshu Tiwari, Somnath Bharadwaj, Suman Majumdar {published MNRAS: DOI}

TECHNICAL SKILLS

- **Operating System**

Linux, Mac, Windows

- **Programming Language**

C, Python, HTML, shell, slurm

- **Software tools**

CASA, CARTA, WSCLEAN, MWA-related tools, Blender (Scientific Visualization), Vim, Visual Studio, Office, PyCharm, Version Control, Github

- **DEVELOPMENT LINKS**

Closure phase analysis: Radio Interferometric closure phase (bispectrum phase) to study EoR-[pipeline](#).

Lunar Occultation to estimate the global 21-cm spectrum using radio interferometry-[pipeline](#).

Fast Radio Burst Estimator: [FRBe](#)

EmuPBK: Artificial Neural Network-based 21-cm signal statistical (Power Spectrum, Bispectrum) emulator and parameter estimation pipeline: [Github](#)

Documentation: [Read the Docs](#)

Visualize Epoch of Reionization: [Animation](#)

Planets 3D-VR Gallery: [Gallery](#)

- **PYTHON-BASED TOOLS USED**

Astropy, Scipy, Numpy, MPI for general projects, Tensorflow (Keras) for Machine Learning, Emcee & CosmoHammer for Bayesian Inference

LIFE SKILLS



CERTIFIED FIRST AIDER, FIRE WARDEN, *Red-Cross Australia: certificate*

AWARDS AND ACHIEVEMENTS

- Awarded **Curtin International Postgraduate Research Scholarship (CIPRS)** net amount AUD\$ **28,597.00**/annum + AUD\$**38,800**/annum Tuition Fee Cover (2021 pro-rata).
- Awarded PhD position at **Curtin Institute of Radio Astronomy (CIRA), Curtin University, Australia**.
- Awarded PhD position at **International Max Planck Research School on Astrophysics (IMPRS), Ludwig Maximilian University of Munich (LMU): Rejected, offer**
- Master of Science (Astronomy) with **First Class Degree**.
- 96% in IIT-JAM (Joint Admission Test for Masters) examination: [score card](#)
- Bachelor of Science Degree with **First Class Degree**.
- Best Talk at Lok Vigyan Kendra (A non-profit science outreach organization): [certificate](#)

PRESENTATIONS N° OUTREACH

- Presented my work on MWA-II closure phase upper limits at the **SKA-India Science Group** Biweekly-meeting (14th March 2024).
- Volunteered in **AstroFest-2023** (Australia's Biggest Astronomy Event)
- Volunteered in the **NASA's Moon observation day** 21st Oct. 2023 in Perth (social outreach event).
- Presented in UU Astro Friday at **Uppsala University** (29th Sept, 2023).
- **Nordita** Colloquium at **Stockholm University** (27th Sept, 2023): [Talk Link](#).
- Presented at **Kapteyn Astronomical Institute, University of Groningen**, Netherlands (25th Sept, 2023).
- Presented my work at **INAF-IRA**, Italy (22nd Sept, 2023): [Talk Link](#).
- Presented my work at **Scuola Normale Superiore di Pisa**, Italy (18th Sept, 2023)
- Presenting my work on MWA-II lunar occultation at the **6th Global 21-cm conference**: [Link](#)
- Presented my work on MWA lunar occultation at the **5th Global 21-cm conference**: [Link](#)
- Presented my work on 21-cm bispectrum & ANN emulator-EmuPBk at the **3rd Global 21-cm Workshop, Cambridge, UK (19-22 Oct. 2020) (online event)**: [Link](#)
- Participated in **Astronomy Astro-3D outreach** event for Kids in Perth
- Participated in the **NASA Sagan Workshop 2021** on Exoplanets
- Participated in **Indian National Science Day-2020**, demonstrated the model of Sun and National Science Day-2020, developed a **VR tour**: [Link my VR tour](#).
- Participated in **Reaching For The Stars (IAU's 100 Hours of Astronomy Event)**.
- Participated in the **Workshop on 21-cm Cosmology** (19-23 April 2021) organised by **SKA India**: [Link](#)
- Participated in the event **SU-UU-IITI (RISU) CD-EoR meeting** (13 Dec. 2020) under **SPARC project**: [Link](#).
- Participated in the **EoR conference SAZERAC** (6-9 July 2020) & gave an online talk: [YouTube Link](#).
- Participated in **Winter School of Observational Astronomy** (29-4th Feb. 2020): [certificate](#)
- Participated in the International conference (20-24 Jan. 2020) and School (27-31 Jan. 2020) on **observing the First Billion Years Of The Universe Using Next Generation Telescopes**.
- Participated in the **International Workshop on Recent Advances in Space Science (RASS)**: [certificate](#)

ADDITIONAL COURSES

-  **SUPER-EARTHS AND LIFE BY HARVARDX**:, [certificate](#)
-  **COMPLETE PYTHON BOOTCAMP**:, [certificate](#)
-  **MODERN DEEP LEARNING IN PYTHON, ANDROID SDK PROGRAMMING, UNITY AR-VR, C-PROGRAMMING FOR BEGINNERS, ETHICAL HACKING WITH KALI LINUX, DAVINCI RESOLVE**,

NON-ACADAMIC JOBS



EXTRA-CURRICULARS

- Organised Intra-House social sporting events: **Cricket, Chess, Tennis, Mini Music Concert: Bollywood Night** during my stay at **Unilodge**.
- Run two small YouTube channels **1st, 2nd**: Interest in **video editing, 3D designing, Film-making, Music & Poetry**.

REFERENCES

- **Prof. Cathryn Trott**
Curtin Institute of Radio Astronomy (CIRA),
Curtin University, Bentley, Perth (6102), Western Australia.
✉ Cathryn.Trott@curtin.edu.au
- **Dr. Benjamin McKinley (Senior Researcher, University Adjunct)**
Curtin Institute of Radio Astronomy (CIRA),
Curtin University, Bentley, Perth (6102), Western Australia.
✉ ben.mckinley@curtin.edu.au
- **Dr. Nithyanandan Thyagarajan (Senior Scientist)**
Commonwealth Scientific, Industrial and Research Organisation, (CSIRO).
26 Dick Perry Ave (6151), Kensington, Western Australia.
✉ nithyanandan.thyagarajan@csiro.au
- **A/Prof. Suman Majumdar (Associate Professor)**
Department of Astronomy, Astrophysics and Space Engineering (DAASE),
Indian Institute of Technology, Indore-453552, M.P., India.
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