Dr. Parth **Nayak**

AI Researcher | Data Scientist | Astrophysicist

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Education

Ph.D. in AI & Astrophysics
LMU Munich | Jan 2026

B.Sc.+M.Sc. in Physics (dual degree)
IISER Bhopal | Jul 2020

Publications

- **Nayak** et al. 2025, arXiv:2510.19899
- Chang, **Nayak** et al. 2025, arXiv:2508.03264
- **Nayak** et al. 2024, A&A 689-A153
- **Nayak** & Saha 2022, MNRAS 510-2

Technical Skills

ML / Deep Learning

Neural networks (CNNs, MLPs), simulation-based inference (SBI), generative models (normalizing flows, diffusion models, autoencoders, GANs)

Other AI / Statistics

LLM fine-tuning & prompt engineering, LLM output evaluation & ranking (RLHF), evolutionary algorithms, Gaussian processes, Bayesian & Monte Carlo methods, mixture models

Programming

Python (proficient); HTML, CSS, Javascript (intermediate); C++, Java (basic)

Python packages

TensorFlow, Keras, PyTorch (familiar), Optuna, NumPy, SciPy, Pandas, Matplotlib, H5Py, AstroPy, HealPy, *among others*

Other IT

High-performance computing (HPC), Git version control, LaTeX typesetting, Markdown, Mac/MS Office, Shell (bash, Z shell)

Languages

English (full working proficiency); Gujarati, Hindi (native/bilingual); German (B1/ intermediate); French (beginner)

Highlights

- 5+ years of research experience in Data Science and AI algorithm development
- Authored 4 research papers on novel AI applications in astrophysics
- Delivered 10+ technical talks at international conferences and research institutes
- Received 5+ academic awards and fellowships

Relevant Experience

Doctoral Candidate: AI & Astrophysics *LMU Munich | Oct 2021 - Jan 2026*
Hightech Agenda Bayern chair of Astrophysics, Cosmology & AI + Munich Center for Machine Learning (MCML)

- Developed a ML inference framework "*LyaNNA*" [lyanna] based on a novel 1D ResNet with Python/TensorFlow from scratch that **outperforms conventional methods** by **>100%** in inference precision for complex, realistic, noisy spectroscopic data (simulation-based inference)
- Developed "*SynTH*" [synth] to model intergalactic absorption from massive cosmological **hydrodynamic simulations** and **synthesize training data** for *LyaNNA*
- Authored 3 research papers on AI for inference in astrophysics [Nayak+ 2024, 2025, Chang+ 2025]

Master's Thesis: AI & Astrophysics *IISER Bhopal | Aug 2019 - Jul 2020*

- Developed a Genetic Algorithm framework "*GA-ILC*" to optimize the reconstruction of cosmic microwave background (CMB) from contaminated observations
  - A novel, **scalable** evolutionary algorithm [geneticalpy] to extract **faint cosmological signals** from **high-noise** environments (foreground removal)
- Authored one paper on evolutionary algorithms in astrophysics [Nayak & Saha 2022]

Freelance Data Annotator *DataAnnotation | May - Jun 2026*

- Ranked and evaluated LLM outputs and assessed prompt-response quality on a contract basis for model training pipelines

Leadership & Supervision

- **Co-supervisor of LMU Master's theses and labs** *Oct 2021 - Dec 2025*
  Designed and supervised two LMU Master's theses, and co-supervised 5+ computational and instrumental lab courses
- **Co-organizer of "Astronomy on Tap" (AoT) Munich** *since Oct 2025*
  Coordinating the monthly outreach event to engage the general public with accessible scientific talks and pub-quizzes
- **Co-organizer of "Meet the Speaker" @LMU Observatory** *Oct 2023 - May 2025*
  Revitalized the weekly series by relocating it to the historic 200-year old telescope dome, a unique atmosphere for students for informal networking with international experts
- **Coordinator & Senior Advisor of IISERB Astronomy Club (IBAC)** *2016 - 2020*
  Played a foundational role as the club's second coordinator, establishing enduring traditions and growing the community into one of India's most popular student astronomy clubs
- **Physics Department Representative** *Aug 2017 - Jul 2018*
  Unanimously elected to serve as the primary liaison between faculty and a class of 60+ physics major students

Selected Awards & Fellowships

- DAAD Research Grant — Ph.D. scholarship *Germany | Oct 2021 - Dec 2025*
- Proficiency Medal in Physics — IISER Bhopal *India | Jul 2020*
- DAAD-WISE Scholarship *Germany | May - Jul 2019*
- INSPIRE Scholarship for Higher Education *India | Aug 2015 - Jul 2020*