ARNAB LAHIRY (M.S., PHYSICS)

DOCTORAL RESEARCHER (PHYSICS | COMPUTER SCIENCE)

N. Plastira, Vassilika Vouton, Heraklion, Crete, Greece +30 698 218 0321 alahiry@ics.forth.gr arnablahiry08@gmail.com
linkedin.com/in/arnab42 github.com/arnablahiry arnablahiry.github.io researchgate.net/profile/Arnab-Lahiry

INTRODUCTION

I have **extensive experience bridging scientific research and advanced computation**. Proficient in handling **large, complex datasets**, **data preprocessing**, **statistical modelling**, and **machine and deep learning pipelines** for scientific insight. I design and implement **scalable algorithms**, **numerical models**, and **distributed / high-performance computing solutions**. A proven **collaborative team player**, I combine **rigorous coding practices**, **rapid learning**, and **creative problem-solving** to deliver high-impact results. Leveraging **strong oral and written communication** and **data-visualisation skills** to drive cross-disciplinary projects.

TECHNICAL SKILLS

Programming: Python (Primary), C, C++, FORTRAN, MATLAB

Machine Learning / AI: PyTorch, PyG, Lightning, TensorFlow, Keras, Scikit-Learn, vLLM, Jax, Optuna, Captum

Numerical / Scientific Computing: NumPy, Astropy, SciPy, h5py, Pandas, SymPy, Cython, PyWavelets

Visualization: Matplotlib, Seaborn, Corner, Plotly, PyVista

Collaboration & Tools: Git, GitHub, GitLab, Jupyter, VSCode, LaTeX, MS Office, HPC (SLURM), HTML5, CSS3

Operating Systems: Linux (Ubuntu, Debian), macOS, iOS, iPadOS, Android, Windows

Statistical Techniques: Bayesian inference & optimisation, Gaussian processes, time series analysis, simulation-based inference

EDUCATION

University of Crete — Heraklion, Crete, Greece
Ph.D. in Physics — *Nov 2023 – Present*

Indian Institute of Science Education and Research (IISER) Tirupati — Tirupati, Andhra Pradesh, India
B.S. - M.S. Dual Degree in Physics — *Aug 2018 – Jul 2023*

CORE EXPERIENCES AND PROJECTS

Doctoral Researcher — Nov 2023 – Present
Foundation for Research and Technology - Hellas (FORTH), Crete, GR — *Institutes of Computer Science & Astrophysics*

Visiting Doctoral Researcher *at LCS, Département d'Astrophysique, UMR AIM, IRFU, Commissariat à l'énergie atomique et aux énergies alternatives (CEA) Paris-Saclay, FR*

- Built scalable **3D spectral datacube** and **multi-dimensional dataset** pipelines from **theoretical physical models** of galaxies, **FITS** and **HDF5** sources for AI workflows.
- Developed an **iterative 2D–1D wavelet-based algorithm** using **multiresolution feature engineering** for 3D signal denoising.
- Designed and trained a **3D U-Net** with **local convolutions, skip connections, and anisotropic multiscale learning** to denoise 3D galaxy datacubes, achieving $>$**95% intensity conservation** and **3–6σ signal-to-noise improvement**.
- Implemented **fully connected** and **1D CNN architectures** for feature inference from galaxy spectra, evaluated via **RMSE metrics** and cross-model consistency checks.
- Created modular **data ingestion, scaling, and normalization pipelines** ensuring reproducible, high-quality preprocessing.

Masters Research Intern — May 2022 – May 2023
Flatiron Institute, Simons Foundation, NY, USA — *Center for Computational Astrophysics (CCA)*

- Applied **2D CNNs and Graph Neural Networks (GNNs)** for parameter inference on simulated cosmological image datasets.
- Built efficient **data preprocessing pipelines** with **log-scaling, Z-score normalization, and parameter standardization**.
- Designed and tuned **CNN architectures** with **batch normalization, dropout, learning rate scheduling**, and **custom log-scaled loss functions**, **hyperparameters optimised** using the Bayesian Tree-structured Parzen Estimator **(TPE) Sampler**
- Implemented **multi-layer message-passing GNNs** on graph-structured data linking galaxies and dark matter haloes.
- Applied **interpretability algorithms** (Saliency, Integrated Gradients, Gradient SHAP) to quantify feature importance.

PUBLICATIONS

"Interpreting Cosmological Information from Neural Networks in the Hydrodynamic Universe" accepted by the *Astrophysical Journal (2025)* [arXiv preprint].

"Deep and Sparse Denoising Benchmarks for Spectral Data Cubes of High-z Galaxies: From Simulations to ALMA Observations" submitted to *Astronomy & Astrophysics (2025)*.

RESEARCH GRANTS

Ph.D. supported by the TITAN ERA Chair project (contract no. 101086741) under the **Horizon Europe Programme** of the European Commission.

TEACHING, WORKSHOPS, AND COMMUNICATION

Astrostatistics Summer School - Crete Heraklion, Crete, GR
Teaching Assistant *16–20 June 2025*

- Assisted in lectures on **classical and Bayesian statistics, optimisation methods, MCMC, Gaussian processes, clustering, deep learning, simulation-based inference, GPU parallelisation**.

CODE / ASTRO Software Development Workshop Evanston, IL, USA
Participant | *Contributor* *4–8 August 2025*

- Learned GitFlow, astronomical software development, Python package building, PyPI deployment, and documentation
- Contributed group project on developing an **end-to-end software package**, **version control** in **GitHub**, **deployment** and hosting on `PyPi` [GitHub Repository]

TITAN Astroinformatics Group, FORTH Heraklion, GR | Paris, FR
Member | *Contributor*

- Presented research in multidisciplinary collaboration meetings

Relevant Conferences
Participant | *Contributor*

- UniversAI: Exploring the Universe with Artificial Intelligence [*2–6 June 2025*] Athens, GR
- ML4ASTRO2: Machine Learning for Astrophysics – 2nd Edition [*8–12 July 2024*] Catania, IT
- COSMO21: Statistical Challenges in 21st Century Cosmology [*20–24 May 2024*] Chania, GR

PERSONAL INFORMATION

Nationality: Indian **Date of Birth:** 28 March 2001 **Languages:** English (Fluent), Hindi (Fluent), Bengali (Native)

Hobbies: Sports (Badminton, Tennis, Padel), Art (Sketching, Painting, Digital Art), Backpacking, Photography, Cooking, Reading