Andres Alejandro Navarro Alsina

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EDUCATION

Argelander-Institut für Astronomie - University of Bonn Bonn, Germany
PhD candidate in Astrophysics 01/2021 - present
Supervisor: Prof. Peter Schneider
Advisors: Dr. Malte Tewes & Prof. Tim Schrabback
Thesis: On the application of Machine Learning regression for getting gravitational lensing shear estimates

Universidade Estadual de Campinas Campinas, Brazil
M.Sc. in Physics 06/2017 - 06/2020
Supervisor: Prof. Flavia Sobreira Grade: 1.0 (german equivalent)
Thesis: *Effects of PSF modeling in cosmological estimates using weak gravitational lensing* Link

Universidad Nacional de Colombia Bogotá, Colombia
M.Sc. in Physics 06/2011 - 06/2017
Supervisor: Prof. Fernando Cristancho Grade: 1.3 (german equivalent)
Bachelor project: *Casos de estudio de imagenología por retrodispersión gamma con potenciales aplicaciones industriales* Link

PROFESSIONAL EXPERIENCE

Argelander-Institut für Astronomie - University of Bonn Bonn, Germany
`Research Assistant` (Euclid Satellite Project) 01/2021 - present

- Designed and deployed deep neural networks to extract galaxy shear signals with 1% signal-to-noise under severe noise conditions (first-author ML paper)
- Processed and analyzed 100+ TB of astrophysical image data, implementing a complete ML pipeline from simulation to catalog generation
- Created a double ML calibration strategy accounting for selection bias, blending, and domain shift
- Developed Bayesian and probabilistic neural network models to quantify prediction uncertainties
- Used test-driven development (TDD) and MLOps practices for scalable deployment on HPC clusters

`Graduate teaching assistant` 01/2021 - present
Courses: Optical observations and Advanced laboratory course in optical astronomy

- Led the computer lab for reducing astronomical images
- Guided observation nights in the telescope.

Universidade Virtual de São Paulo Campinas, Brazil
`Instructor` 02/2020-10/2020
Courses: Basic mathematics, Practices in teaching mathematics, Object-oriented programming

Gleb Wataghin Institute of Physics - Universidade Estadual de Campinas Campinas, Brazil
`Research Scholar` (Dark Energy Survey Collaboration) 06/2017 - 06/2020

- Developed null tests for mitigating systematic errors in correlated multivariate datasets (paper)
- Developed a Bayesian inference pipeline using Markov Chain Monte Carlo to quantify modeling errors on parameter estimation (paper)
- Conducted forecast analysis with thousands of mock datasets to assess confidence interval shifts (paper)

`Graduate teaching assistant` 08/2018-06/2020
Courses: Physics I (mechanics), II (oscillation and waves) and IV (nuclear physics)

Nuclear Physics Group - Universidad Nacional de Colombia Bogotá, Colombia
`Colciencias Scientific initiation scholar` 06/2016-06/2017
Project: Design of new analytical methods in gamma spectroscopy for basic research and applications

- Characterized and simulated a gamma radiation camera using Compton scattering to produce images
- Coded image analysis tool for image border detection and sharpening

Academic Administration - Universidad Nacional de Colombia Bogotá, Colombia
`Undergraduate physics tutor` 06/2016-06/2017

The Brazilian Synchrotron Light Laboratory - CNPEM Campinas, Brazil
`Summer scholar` 01/2015-03/2015
Program: 24° Summer student program of CNPEM
Project: Synthesis and characterization of transition metal thin films for catalysis applications

Nuclear Physics Group - Universidad Nacional de Colombia Bogotá, Colombia
`Research intership` 06/2014-12/2015
Project: Experimental characterization and numerical simulation of the detection systems at Applied Nuclear Physics Laboratory

Physics Department - Universidad Nacional de Colombia Bogotá, Colombia
`Undergraduate teaching assistant` 03/2014-06/2014

TECHNICAL SKILLS

- Programming: Python (8 yrs), C++ (5 yrs), Java (1 yr), SQL (1 yr)
- ML Frameworks: TensorFlow (4 yrs), PyTorch (1 yr), Keras, Scikit-learn, statsmodels
- Python Ecosystem: Numpy, Pandas, Matplotlib, Scipy, Jupyter, ipython, ray
- MLOps & DevOps: git, Docker, Bash, pytest, Conda, virtualenv, TDD
- HPCC & cloud: SSH, VNC, HPC clusters (Cori NERSC, MPCDF, Marvin), Google Cloud Platform, SLURM, HTcondor, GPU-based model training, CUDA
- Other tools and packages: LaTeX, Emacs, cuda, Doxygen, Root-CERN, Geant4, +10 astro software
- Github: `https://github.com/andalenavals`

MACHINE LEARNING

- Feature engineering, linear/logistic regression, classification, anomaly detection, clustering, NLP
- Methods and algorithms: Decision Trees, Random Forests, k-means, Principal Component Analysis, Self-Organizing Maps, Single Value Decomposition, Independent Component Analysis, Gaussian Mixture Models, Bayesian optimization, Markov Chain Monte Carlo
- Neural Networks: Shallow NNs, deep NNs (CNNs, ResNet, U-Net, Autoencoders), Bayesian NNs, Probabilistic NNs, custom architectures with tailored loss functions

Languages

✔Spanish: Native ✔English: C1 ✔Portuguese: C1 ✔German: B2

Scholarships and Awards

1. Member of the International Max Planck Research School (IMPRS) of Bonn and Cologne
2. CNPq scholarship (top results, admission exam carry by the Brazilian Physics Society in 2017)
3. Andres Bello Distinction (2010) (top results in the national exams ICFES)

Selected publications arXiv

- Euclid: Weak-lensing shear measurement with machine learning, sensitivity to blending, morphology, and galaxy distribution changes. **A. Navarro-Alsina**, M. Tewes, T. Schrabback, et al., (in prep)
- Dark Energy Survey Year 3 results: Cosmology from cosmic shear and its robustness to Data Calibration (A. Amon, D. Gruen, M. A. Troxel, N. MacCrann, S. Dodelson, A. Choi, C. Doux, L. F. Secco, S. Samuroff, E. Krause, J. Cordero, J. Myles, J. DeRose, R. H. Wechsler, M. Gatti, **A. Navarro-Alsina**, et Al (link, 2021)
- Dark Energy Survey Year 3 Results: Weak Lensing Shape Catalogue. M. Gatti, E. Sheldon, A. Amon, M. Becker, M. Troxel, A. Choi, C. Doux, N. MacCrann, **A. Navarro Alsina**, et Al (link, Nov 2020)
- Dark Energy Survey Year 3 Results: Point-Spread Function Modeling. (M. Jarvis, G. M. Bernstein, A. Amon, C. Davis, P. F. Léget, K. Bechtol, I. Harrison, M. Gatti, A. Roodman, C. Chang, R. Chen, A. Choi, S. Desai, A. Drlica-Wagner, D. Gruen, R. A. Gruendl, A. Hernandez, N. MacCrann, J. Meyers, **A. Navarro-Alsina**, et Al (link, Nov 2020)
- +40 articles in second tier of authorship as DES/Euclid member (Link to full list)

CONFERENCES AND TALKS

1. Euclid Consortium Meeting 2024, Rome, Italy (June 2024)
2. Euclid Consortium Meeting 2023, Copenhagen, Denmark (June 2023)
3. 16th IMPRS Conference, Bonn, Germany (March 2023) (**talk**)
4. Euclid OU-SHE and Weak Lensing SWG Meeting, Ebinburgh, Scotland (virtual) (December 2022) (**talk**)
5. 12th IMPRS Conference, Bonn, Germany (May 2022) (**talk**)
6. Euclid Consortium Meeting 2022, Oslo, Norway (April 2022)
7. Euclid Consortium Meeting 2021 (virtual) (May 2021)
8. IV encuentro internacional en ingenierías de la Universidad Popular del Cesar Colombia y el II Congreso Internacional en Informática y Ciencias de la Computación del Tecnológico Nacional de México Campus Perote, Veracruz México (**speaker**) Link
9. VIII Congreso Internacional de Innovación y Apropiación de las Tecnologías de la Información y las Comunicaciones CIINATIC 2021 (**speaker**) Link
10. Debating the potential of machine learning in astronomical surveys (virtual) (October 2020)
11. VII Euclid Developers Workshop (virtual) (October 2020)
12. Advanced Euclid School: The science of future cosmological surveys, Les Houches, France (virtual) (15-26 June 2020)
13. III Joint ICTP-Trieste/ICTP-SAIFR School on Observational Cosmology, Sao Paulo, Brazil (July, 2019)
14. Dark Energy Survey Collaboration Meeting, Campinas, Brazil (December, 2018) (**talk**)
15. Winter school of Observational Cosmology, UNICAMP, Campinas, Brasil (July, 2018)
16. III Particle Detector School, UniAndes, Bogotá, Colombia (November, 2016) (**poster**)
17. II Latinamerican School on Medical Physics, UdeA, Medellin, Colombia (December, 2015)
18. XI LASNPA, UdeA, Medellin, Colombia (December 2015) (**poster**)
19. II Andean School on Nuclear Physics, SGC, Bogotá, Colombia (October,2014) (**poster**)